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THE CAREER OF HERBERT SPENCER

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THAT "the evil that men do lives after them; the good is oft interred with their bones," is one of those literary palindromes which may be read both ways. Probably there is no great man, who, from the standpoint of pragmatism, has not done both evil and good, but the question as to which predominates can never be decided to the satisfaction of all. In the case of a Nero most men are agreed, but in that of a Napoleon opinions differ. Aside from war and politics there are few cases in which the consensus of opinion would fall on the side of evil, but many cases leave it doubtful, as, for example, those of Machiavelli, Hobbes and Rousseau, while in others it changes from one age to the next, as in the cases of Voltaire and Thomas Paine. Usually it is the evil that is most conspicuous during the life of the subject, and this has often been carried to the extreme of persecution during life and canonization after death. The world is full of monuments to those who were put to death for the things that are now chiefly admired. All this admonishes the biographer of the caution required in passing judgment on those of his own day and generation.

Herbert Spencer stands, and will probably always stand, on the light side of the picture, but there are very few of those familiar with his work who would maintain that there is no dark side. His Autobiography naturally presents the bright side, but the Life and Letters emphasize rather the shades than the lights, and it may be doubtful whether it would not have been better if that work had not appeared. Still, when we remember the deficiencies of human nature, perhaps this showing up of the whole man as he was is nothing more than a reassertion by him of the universally approved maxim of Terence: *homo sum.*

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Leaving the world, then, to pronounce its judgment on this question of ethics, or pragmatism, let us briefly consider the career of Herbert Spencer in its broad outlines as brought out by his complete works supplemented by the four posthumous volumes now before us. There is certainly no vehicle in America, if there is any in the Old World, more appropriate to this task than the POPULAR SCIENCE MONTHLY. As has already been said by its present editor:

> Readers of this journal are familiar with Spencer's work, for he contributed to it nearly a hundred articles. It was indeed established by Dr. E. L. Youmans in 1872 largely with a view to provide a suitable medium for printing Spencer's "Study of Sociology," and . . . may be regarded as one of the by-products of his genius.[1]

As is well known, the first article in the POPULAR SCIENCE MONTHLY (May, 1872) is by Herbert Spencer: "The Study of Sociology, I., Our Need of It," which is also the first chapter of the book he was writing on "The Study of Sociology" for the International Scientific Series. In his "Autobiography" (Vol. II., pp. 284–286) he says:

> Before he left England my American friend [Dr. E. L. Youmans] volunteered to arrange for the carrying out of a suggestion which had arisen, I do not remember how, that the successive chapters of "The Study of Sociology"—the extra book in question—should be first published serially, in England and America at the same time. Here the *Contemporary Review* . . . was the contemplated medium; and a fit medium in the United States, Professor Youmans proposed to negotiate with as soon as possible after his return. . . . And now there arose an unlooked-for result from the understanding that had been made for simultaneous publication in America. Negotiations which Youmans had carried on with one or other periodical in the United States had all failed; and at the time when the first chapter had been put in type, neither he nor I saw how our plan was to be carried out. When the proof of this first chapter reached him it caused prompt and surprising action, as witness the following extract from a letter of his dated April 3, 1872:
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> "A thousand thanks for your favour of March 13th, with article on 'Study of Sociology' enclosed . . . You did wisely in sending it, and I decided upon our course in ten minutes after getting it. I determined to have a monthly at once, and in time to open with this article . . . We have started a monthly of 128 pages . . . I am utterly glad that things have taken the course they have. I have wanted a medium of speech that I can control, and now I shall have it."
>
> The magazine thus started was *The Popular Science Monthly;* which, under the editorship of my friend, has had a prosperous career and done very good work.

Not only did the "Study of Sociology" thus all appear in the POPULAR SCIENCE MONTHLY, but Mr. Spencer continued to contribute to it chapters from his "Synthetic Philosophy" for many years, and declined to allow them to appear in other periodicals. When asked as

[1] POPULAR SCIENCE MONTHLY, September, 1908, Vol. LXXIII., p. 285.

late as 1895 by the London editor of *McClure's Magazine* to contribute to that journal, he replied:

> I have, in virtue mainly of my indebtedness to my old friend for all he did on my behalf in the United States, felt bound to make the *Popular Science Monthly* my sole medium for publication of articles in the United States, and the obligation, which was preemptory during his life, remains strong after his death, since his brother occupies his place and he has continued his good offices on my behalf.[2]

The choice of a spokesman is less happy, but when we remember that the brothers Youmans, John Fiske, and most of the other disciples of Spencer in America have passed away, the difficulty in finding a proper person for such a task will be appreciated. Probably it should have fallen to an unqualified disciple who would simply pronounce an *éloge* in some extended form. The one to whom it has been assigned, while he yields to none in his high estimate of Spencer's talents and achievements, and has made this known on many occasions, has remained eclectic as to his peculiar doctrines, accepting such as appeal to him as sound, rejecting those which seem to be obviously unsound, and suspending judgment as to many that appear doubtful or await sufficient evidence.

In these several respects it is possible to classify Spencer's views under two heads and to explain the reasons which assign them to the one or the other class. The first class includes his cosmic philosophy in general, beginning with inorganic nature and extending through biology. It also includes much of his psychology, anthropology and sociology, considered in their philosophic aspects. The second class embraces his ethics as a whole, both individual and political. To it also belong most of the applications that he makes of psychology and sociology to current events, his dealings with the state, government, war, industry, business and economic problems. While no one will go so far as to say that his views on the first of these classes are always sound, or that those on the second are always unsound or questionable, it is still true that all that is great and profound in his philosophy belongs to the first of these classes, while his errors, his narrow views, and his unworthy utterances are confined to the second class.

And now as to the explanation of this. Primarily it rests on the fact that in treating the first class of subjects there was no room for the play of the emotions, while the subjects of the second class often appeal to the feelings, and Spencer, with all his logic and philosophic poise, never had his feelings under complete subjection to his reason. But secondarily, in the case of topics appealing to the feelings he unfortunately imbibed a whole series of prejudices during his early youth from which he was never able to free himself. Indeed, they were so

[2] "Life and Letters," Vol. II., p. 89.

strong that he did not attempt to overcome them, but rather gloried in them to the end of his life. This, however, was not the worst consequence. They blinded him to everything that was taking place in the world around him, to the extent that social movements, which, could he have seen it, were the natural outcome of the cosmical principles he had laid down, were regarded by him as the signs and omens of social degeneracy and as portending a relapse into barbarism. In the inorganic and organic worlds he had not been taught anything, and his vast intellect was free to enter those fields and work out far-reaching principles untrammeled by early prejudices. In the ethical, political, and economic worlds he was enclosed in a shell and could grow no larger than his prison walls. To use one of those biological analogies of which he was so fond, in the physical and organic sciences he was a vertebrate with an adjustable internal skeleton, while in the moral and political sciences he was a crustacean without the power to shed his carapace.

In appraising Spencer's truly great contributions to human thought and knowledge we are therefore compelled to leave out of view all his earlier writings, except perhaps an occasional essay. His letters on the "Proper Sphere of Government" (1842), his "Social Statics" (1850), his "Principles of Psychology" (1855), his "Education" (1861), are all excluded from this high meed of praise. The same is true of Part I. of his "First Principles" (1862), which formed the stumbling-block to his whole system of philosophy, and if published at all, should have been placed at the end as a sort of appendix or curious metaphysical by-product. Solid ground is reached only in Part II. of the "First Principles," and in only one other of his works is his master mind revealed with equal clearness. His grasp here of cosmical principles is astonishing, and the vast swing of his logic carries the reader irresistibly on, sweeping majestically across the whole cosmos in many different directions, until everything is compassed in a universal scheme. Here, too, more than anywhere else, is his happy choice of expressions, never before employed, but precisely and concisely characterizing cosmical principles, singularly manifest. The word "evolution" itself, which perhaps he was the first to use in a philosophic sense,[3] though introduced in his earlier works, is here given its full meaning, and the thought it conveys has now captured the world. The phrase "redistribution of matter and motion" sums up the cosmic process as it had never been summed up by any other phrase. The assertion that evolution proceeds "from the homogeneous to the heterogeneous" has never been questioned except by those who give different meanings to the terms from those intended by Spencer, and which are the proper and even the popular meanings. Such phrases as "the

[3] "Life and Letters," Vol. II., p. 329.

instability of the homogeneous," "the rhythm of motion," "the multiplication of effects," and such single terms as "aggregation," "segregation," "equilibration," "dissolution," are all fraught with profound significance, and most of the processes described by them take place in all departments of nature. The introduction and illustration of these terms and the description of the processes of nature of which they are the names, would alone make "First Principles" an immortal work.

It is true that Spencer failed to see the essential distinction between cosmic and organic evolution, and when it was pointed out in 1877,[4] as it was not his own idea, he characteristically ignored it. He also missed the principles of creative synthesis, cosmic, organic and social synergy and sympodial development, which are quite as important as those set forth in "First Principles." But he is to be judged for what he did rather than by what he did not do. There is, however, one omission, which, deliberate and intentional though it was, has not been condoned by his readers. This is his failure to elaborate these fundamental principles of inorganic nature in a manner proportionate to that in which he elaborated the principles of biology, psychology, sociology and ethics. Uniform regret has been expressed by his readers, including his warmest admirers, that he should have abandoned this great work so auspiciously begun, and hurried on to the more special and complex sciences before laying an adequate foundation for them. The present writer was among those to express this regret and to maintain that his excuse for omitting the two volumes upon which the "Synthetic Philosophy" would and should have rested, viz., that the scheme would have been too extensive for him to complete it, and that "the interpretation of Organic Nature after the proposed method is of more immediate importance," was not a sufficient or valid excuse. It is generally felt that if these two volumes had been written, which might have borne the title of "Principles of Cosmology," it would be small matter whether the "Principles of Ethics" ever saw the light or not.

The world was even left in the dark as to how and in what order he would have treated inorganic nature had he written the omitted volumes. It is true that in the opening paragraph of the first volume of the "Principles of Sociology" he says:

> Of the three broadly-distinguished kinds of Evolution, we come now to the third. The first kind, Inorganic Evolution, which, had it been dealt with, would have occupied two volumes, one dealing with Astrogeny and the other with Geogeny, was passed over because it seemed undesirable to postpone the more important applications of the doctrine for the purpose of elaborating those less important applications which logically precede them.

The bare names, therefore, which he would have given to the two

[4] POPULAR SCIENCE MONTHLY, October, 1877, Vol. XI., pp. 672–682.

volumes were thus made known, but from them it was impossible more than to conjecture what the treatment would have been. The complete scheme was drawn up early in 1858 and sent to his father in a letter, but the revised scheme, issued in 1860, and with which we are all familiar, wants the details for all below the biology. Not until the "Autobiography" appeared in 1904 was this hiatus supplied.[5] This was the reason for publishing a letter from him dated September 19, 1895, in which considerable was said on this subject. Nearly eight years, however, were allowed to elapse before this step was taken in 1903. His permission to publish it would have been asked had it not been known that at that date Mr. Spencer was nearing his end, his death occurring in December of the same year, and it seemed highly important that information so vital to his system should not be lost.[6]

While, therefore, Mr. Spencer's treatment of inorganic nature, so far as it could be judged from "First Principles" and other indications, was full of promise, still, inasmuch as he did not fulfil that promise by an exhaustive elaboration of it, it was soon overshadowed by his work in the next great field, that of biology, the only other field of his labors in which no early preconceptions existed to warp his judgment or impede the flight of his genius.

Herbert Spencer's "Principles of Biology" is the gem of his "Synthetic Philosophy," and must rank for all time as his masterpiece. In it he founds the science of biology squarely upon that of organic chemistry, and "Chemical Development" was to have been the final topic of "The Principles of Geogeny."[7] This makes clear the filiation of the sciences thus far. Then come his several proximate definitions of life, closing with "the broadest and most complete" one: "the continuous adjustment of internal relations to external relations." Few have been satisfied with this, and the more it is studied the less it seems to fulfil the conditions. The objection to it is that there is no life in the definition. It is strange that he should have failed to cement the lowest organic science, biology, to the highest inorganic science, chemistry, by recognizing the brief step from the spontaneous molecular activities of the most complex organic compounds, the albuminoids, to the no more spontaneous molar activities (motility) of the simplest living substance, which we know as protoplasm, and believe to result from the further recompounding of the former.[8]

[5] "Autobiography," Vol. II., p. 17; "Life and Letters," Vol. II., pp. 158–159.

[6] "Pure Sociology," pp. 66–67. A portion of this letter appears in "Life and Letters," Vol. II., pp. 90–91. Mr. Duncan should have mentioned this earlier publication of the letter in full followed by the reply to it and a further discussion of the principles involved.

[7] "Life and Letters," Vol. II., p. 159.

[8] *Cf.* "The Organic Compounds in their Relations to Life," *Proc. A. A. A. S.*, Vol. XXXI., pp. 493–494; *The American Naturalist*, Vol. XVI., December, 1882, pp. 968–979.

But this fundamental criticism aside, Spencer's handling of biological problems is nothing short of masterful. In his chapters on growth, development, function, adaptation, generation ("genesis"), heredity, variation, etc., although not a specialist in any branch of biology, he marshals an immense body of facts in support of fundamental principles, many of which had never before been discovered. In dealing with heredity he postulates the existence of "physiological units," later changed to "constitutional units." The "Principles of Biology" was published in 1864, and therefore Spencer could have known nothing of Darwin's "pangenesis," treated in his "Variations of Animals and Plants under Domestication," which appeared in 1868. But Spencer's "physiological units," as he points out,[10] are not at all the same as Darwin's "gemmules." They are still less similar to Weismann's "biophores."[11] They are nothing but "compound molecules (as much above those of albumen in complexity as those of albumen are above the simplest compounds," and are for the same organism "substantially of one kind." Why he did not admit that they are merely forms of protoplasm we do not know, but certain it is that biologists are now coming to believe that no hereditary units in the sense of independent bodies exist, and that all the phenomena of heredity, obscure and recondite as they are, can be as easily conceived to result from the action of protoplasm in various ways not yet fully understood, as from any imaginary bearers of hereditary "Anlagen."[12]

It is in Part III. on the "Evolution of Life" that the philosopher comes forth in his full power. After disposing of the special creation hypothesis, he attacks the cosmic principles underlying the organic world. Many of those enumerated in "First Principles" are shown to be in full force on the biotic plane. The process from homogeneity to heterogeneity finds its clearest exemplifications here, and the two great principles of differentiation and integration are formulated and illustrated with wonderful force. We can not here even enumerate all the biological principles set forth in this work, but the application of the principle of equilibration to the organic world can not be passed over in silence. The Lamarckian principle of increase by use and atrophy from disuse, called somewhere by Spencer "use-inheritance," and early recognized by him as "the inheritance of functionally-acquired modifications," now becomes, in the new terminology of biology, "direct equilibration," while natural selection, which Spencer, along with many others mentioned by Darwin in the later editions of the "Origin of Species," had foreshadowed before that work appeared,

[10] "Life and Letters," Vol. I., p. 199.

[11] *Ibid.*, Vol. II., p. 52.

[12] *Cf.* Minot, "The Problem of Age, Growth, and Death," New York, 1908, pp. 233 ff.

becomes "indirect equilibration." The discussion of these two principles is among the most profound of all of Spencer's writings. The subject, so intimately connected with this, of the transmission of acquired characters, was not overlooked in the "Principles of Biology," but it was not brought into the foreground until Weismann's "Essays" began to appear, denying its possibility. Spencer, as is known, entered the lists with his paper on "The Factors of Organic Evolution," and continued to reply to Weismann for a number of years. In him the trained biological specialist found a foeman worthy of his steel. Readers of these papers on both sides will of course differ in their judgments on the argument according to their cast of mind, but all will admit that Spencer's presentation of the case was able, and to it, as much as to anything else, were due the many notable concessions that Weismann was from time to time compelled to make.[13]

In the second volume of the "Principles of Biology," devoted mainly to morphology and physiology, Spencer showed that he could play the rôle of a specialist, but his special studies and illustrations all have a philosophic purpose in establishing principles. These, however, belong for the most part to the minor or more special laws of biology, and do not call out the same philosophic powers as the major and more general laws dealt with in the first volume. Perhaps the most important of these laws is what he calls the "antagonism between growth and sexual genesis," which might otherwise be stated as the law that nutrition and reproduction are inversely proportional. The truth of this is known to practical breeders, florists and horticulturists, but not to the general public, and it has some interesting results.

Spencer lived to revise his "Biology" and introduce into it much of the Weismann controversy and other features which had not presented themselves clearly at the time the work was originally written. Upon the whole it is a remarkable work. Surprise has often been expressed that trained specialists in biology had rarely or never been able to trip him on any of his statements. This is partly explainable by the fact that Professor Huxley read the proof of a considerable part of the work, but it does not appear that he found much to correct, and we must admit that Spencer possessed a remarkable faculty of accurately stating biological facts that he had not himself observed, and a still greater talent for correlating and interpreting them and fitting them into his universal scheme.

Let us now turn to the "Principles of Psychology." In his "Synthetic Philosophy" Spencer placed it after the Principles of Biology. Although he says little about his reasons for this arrangement, it seems clear that he regarded it as the order of evolution. Yet

[13] *Cf.* Weismann's "Concessions," POPULAR SCIENCE MONTHLY, Vol. XLV., June, 1894, pp. 175–184.

in his attacks on Comte's serial classification of the sciences he denies that there is any serial order.[14] But whenever he mentions the subjects of his "Synthetic Philosophy" he always arranges them in the same order,[15] corresponding to that of his original program and of all subsequent programs. No one will probably question the propriety of this arrangement, and it may be inferred that he regarded psychology as having some such relation to biology as the latter has to chemistry, *i. e.*, as in a sense growing out of it. Now, whereas he does clearly show this filiation of biology and chemistry, it is difficult to find in his psychology a recognition of its dependence upon biology in the same sense. This is probably due to the fact that the "Psychology" was first written and published as an independent work several years before he conceived the idea of a "Synthetic Philosophy," and afterward revised, enlarged, and adapted, and then set up in its proper niche in the general structure. But the task of adapting it was not an easy one, and he seems to have devoted himself more to what he regarded as its improvement, to the answering of criticisms, and to bringing it up to date, than to linking it on to his "Biology" which stands before it, and to his "Sociology," which was to follow.

He wrote the "Psychology" when fresh from the reading of Hamilton, Mansel, Mill and Kant, and the point of view was that of the old philosophy of mind, which he, indeed, attacked, but scarcely from the modern scientific point of view. This is more true of the second volume than of the first. The work opens, as do most works on psychology, with a treatise on the nervous system, and the chapter on Æstho-physiology is certainly luminous and forms a new departure. His definition of mind as consisting of feelings and the relations between feelings is inexpugnable. In part III. he treats of life and mind as "correspondence," but does not seem to regard mind as an outgrowth of life. In treating pleasures and pains at the end of part II, he recognizes the existence of feelings which do not consist of pleasure or pain, and even calls them "indifferent," but he does not there or elsewhere show that the function of such feelings is to furnish knowledge. This was perceived by Reid, though he did not grasp its import. Spencer thus fails to show the genesis of the rational powers. He clearly sets forth the biologic origin of feeling, but he does not perceive that the intellect was also an advantageous attribute whose origin can be explained on natural principles. Notwithstanding the acknowledged ability of this work, these and other deficiencies deprive it of the title given it by some of being Mr. Spencer's *chef d'œuvre*. Standing as it does between the "Biology" and the "Sociology," with neither of

[14] "Life and Letters," Vol. I., p. 97; "Pure Sociology," p. 66 (this part of his letter is omitted in the "Life and Letters," Vol. II., p. 90.

[15] "Life and Letters," Vol. II., pp. 285, 328.

which it is adequately linked, it seems isolated and solitary. The failure clearly to affiliate mind upon life is not its worst fault. From the standpoint of the sociologist the most glaring defect is the absence of all recognition of the psychologic basis of social phenomena. Neither in the "Psychology" nor in the "Sociology" which follows is there to be found any attempt to show what are the underlying causes of social phenomena. The nature of social energy which moves the world is nowhere set forth, the distinct rôles played by feeling and thought, as the motor and rector[16] agencies of both the individual and society are not recognized, and both psychology and sociology are thus reduced to mere descriptive sciences. Much the same may be said of his failure to recognize a vital energy in biology with motility as the dynamic agent, which also leaves biology in the descriptive stage. Life and mind are forces, and organic, psychic and social structures are magazines of energy. Any system that fails to recognize this is not a full-fledged science.

It may be said that Spencer constantly insisted that it was feeling and not ideas that moved the world, as opposed to Comte's statement that ideas govern or overthrow the world. It is clear that he misunderstood Comte, who held the same view as Spencer, and that the two statements are not antagonistic.[17] Spencer also said that "the will is a product of predominant desires to which the reason serves merely as an eye."[18] This is very true, and Schopenhauer had said it forty years before him. But such scintillations of the truth do not make a science nor justify us in saying that he thereby furnished sociology with a psychologic basis.

Coming now to the "Principles of Sociology," we find that the work was not hampered by any previous work, and, as in the "Biology," the field was clear for a new start in a most alluring direction. If the order in which the volumes of the "Synthelic Philosophy" stand is the order of nature, marking the course of evolution, we should expect to find the "Sociology" opening with a chapter or an introductory part setting forth the causal connection between sociology and psychology. But, just as no causal connection was shown between biology and psychology, so none appears binding psychology and sociology together. This confirms what was said of the isolated condition of the "Principles of Psychology." What we do find, however, is a rather definite intimation that it is biology rather than psychology that forms the natural basis of sociology. How could any one be expected to doubt this when nothing is said in the first volume of the "Sociology" about its relation to psychology, while, after the long treatise on the beliefs,

[16] Used by Fourier in this sense ("*moteur et recteur*").

[17] *Cf.* Applied Sociology, pp. 41–43.

[18] *Westminster Review*, January 1, 1860, p. 93.

customs, and ideas of primitive races, belonging rather to anthropology, we find in part II. that "a society is an organism," and that social growth, social structures, social functions and social organs are treated from the strictly biological point of view? Mr. Spencer denied that he based sociology upon biology and censured two American authors for intimating that he seemed to do so, but the comparison that he used is not at all apposite.[19]

The other two volumes of the "Principles of Sociology," based as they are on his great compilation, "Descriptive Sociology," are above criticism in their comprehensive sweep as a vast induction. Some of his facts will, of course, be denied, but he admitted that the reports of travelers must be taken with many grains of allowance. Yet these are almost the only sources from which an author who is not himself a traveler must rely. For those therefore who consider such a work to constitute "Sociology" the only vulnerable part is the terminology, classification, and arrangement of the subject-matter. The phrase "ecclesiastical institutions" may be justly objected to as seeming to predicate something like a church of the religious structures of primitive man. The word "ecclesiastical" might be stretched sufficiently to justify this were there no better term, but it is universally admitted that the priesthood was practically coeval with human society, and we possess an adjective corresponding to this noun which is more euphonious and more expressive than the one used. By all means, then, should the phrase *sacerdotal institutions* be substituted for "ecclesiastical institutions." The introduction of "political institutions" between the "ceremonial" and the sacerdotal is a forced arrangement. The ceremonial are largely sacerdotal, and their separation is difficult. The sacerdotal should probably stand first, and the "professional," beginning with the "medicine man," so similar to a priest, should follow. "Political institutions" would then be in order, to be followed by "industrial institutions." But Mr. Spencer had no conception of gentile society and the fundamental distinction between it and political society, so clearly set forth by Morgan. This classification shows how late the latter class of institutions have always been in the historical development of society. Still less was he acquainted with that other most important of all transformations which is undergone by every advanced society at the proper stage in its history, viz., union and amalgamation of groups, whether through war or peace, by which a third and higher group results from the blending of two lower groups, constituting what is appropriately called the cross-fertilization of cultures. It is only through this that all the higher political, industrial, economic, and professional institutions arise.

After thus threading the mazes of cosmic, organic, psychic and

[19] "Life and Letters," Vol. II., p. 357.

social phenomena, we come at last to the "Principles of Ethics," which Mr. Spencer regarded as the crown of his system. One can not but be struck by the resemblance in this respect of Herbert Spencer's career to that of Auguste Comte. Both began with a lively interest in what may be called political ethics, an interest which they both continued to feel through life. But both saw, after their early survey of the field, that the world was not ready for their final achievement, and therefore both stopped and devoted twelve or fifteen years of arduous labor to laying a scientific foundation for the *magnum opus* which was to reform the world. Comte laid special stress on this, and placed as a motto at the head of the first volume of his "Politique Positive" the lines of Alfred de Vigny:

> Qu'est-ce qu'une grande vie?
> Une pensée de la jeunesse, exécutée par l'âge mûr.

Spencer could not even wait to complete the last of the preparatory works, and stopped in the middle of it to write the final work. So strongly was he impressed by the importance of this last work, and so apprehensive that he might not live to complete it, that he said in the preface to the first part ("Data of Ethics" issued separately):

> I am the more anxious to indicate in outline, if I can not complete, this final work, because the establishment of rules of right conduct on a scientific basis is a pressing need. Now that moral injunctions are losing the authority given by their supposed sacred origin, the secularization of morals is becoming imperative. Few things can happen more disastrous than the decay and death of a regulative system no longer fit, before another and fitter regulative system has grown up to replace it.

The implication of course is that Herbert Spencer's "Principles of Ethics" will henceforth constitute the Koran of moral doctrine to the exclusion of all other codes! Comte has been pronounced an egotist and a fanatic for proclaiming himself the high priest of the religion of humanity, but he never assumed to be an infallible pope in the domain of moral conduct. The parallelism, however, does not end here. The world has passed judgment upon Comte's career, and while his final work for which he had lived and labored, viz., his "Positive Polity," has been declared a mistaken dream, the preparatory work, his "Positive Philosophy," which he intended to be only the pedestal upon which the monument was to stand, is looked upon by most men as a path-breaking, by many as an epoch-making achievement, and as marking the beginning of scientific philosophy. In Spencer's case it is too early to speak thus definitely, but all things point to the complete rejection of his political ethics as outlined in "Social Statics" and perfected in his "Principles of Ethics" and "Man Versus the State," while his cosmic philosophy, which he regarded as little more than a

foundation for the other, grows more solid with time, and is clearly seen to be too massive for the flimsy superstructure that he sought to erect upon it.

In Spencer's system ethics is placed last in the series of subjects or sciences, as if it were the highest evolutionary product. Although he laid no stress on the serial arrangement of the sciences, and in his little book on the "Classification of the Sciences," written to refute Comte's "hierarchy," he practically ignores it, still he could not answer the charge of arranging his volumes in practically the same order as Comte arranged the sciences. Nor did he deny that he regarded this as the order of evolution. As Comte did the same for his "Morale," the implication is that they both regarded ethics as a science of the same type as the others, only higher in the scale, and, in fact, the highest of them all. It would thus grow out of and be affiliated upon sociology. The treatment of it does not in either case sustain this claim. In Spencer's case this is much more marked than in Comte's, because they had quite different ideas of what constitutes a moral science. Spencer, as we have seen, regarded it simply as a "regulative system," which is not a science at all. His treatment of it virtually carries out this idea, and his "Principles of Ethics" scarcely differs from the traditional moral teaching of other writers, except that it is "secular" and recognizes no religious or "ultra-rational" sanction. After he had abandoned his "absolute ethics," as set forth in his "Social Statics" (expunged from the last edition), but shown to be false by a study of the widely divergent moral ideas of the races of men, the last claim to the title of a science had been withdrawn from ethics, and it stood at the head of the system having no organic connection with the other sciences of that system. What, then, is his ethics? It is simply an attempt to make a practical application of the true sciences, especially of sociology to human needs. In so far as it is a science in any sense, it is an applied science, and the greater part of it may be denominated applied sociology.[20]

The subject of Spencer's relations with Comte and the similarity of their ideas has been purposely avoided in this article, because it presents the least attractive side of a great man's mind. His overweening affection for what he called "the progeny of the brain,"[21] his intense love of originality, which often seems to exceed his love of truth, and his morbid sensitiveness to any apparent appropriation of his ideas, blinded him to the merits of others and often led him to refine upon a distinction without a difference. Jealousy as well as envy may be a compliment. This can alone explain Spencer's attitude toward Comte. He must have felt, and been oppressed by the fact,

[20] *Cf.* "Applied Sociology," pp. 317–318.

[21] "Life and Letters," Vol. I., p. 254.

that there was a man on the other side of the Channel who, like himself, was striving to give the world a philosophy of science. And in fact, from this point of view, Auguste Comte was to the first half of the nineteenth century what Herbert Spencer was to the second half.

A fuller discussion of the merits and demerits of Spencer's political ethics is also purposely avoided in this place, partly for want of space, partly because it would have to be too critical for the appraisement here proposed, and partly because it has already been attempted, not only by others but by the present writer.[22]

The statement has been so frequently made that Mr. Spencer's sociology and his political and economic doctrines do not logically follow from his law of cosmic and organic evolution, that something more might naturally be expected here on that point than has been said above as incidental to the discussion of other questions. This subject is, however, too large to be treated here, and would require a separate article. This lack has been partially supplied in other places and to these sources the reader is referred.[23]

[22] "The Political Ethics of Herbert Spencer," *Annals of the American Academy of Political and Social Science*, Vol. IV., January, 1894, pp. 582–619. Publications of the Academy, No. 111.

[23] "Herbert Spencer's Sociology," *The Independent*, New York, March 31, 1904, Vol. LVI., pp. 730–734; Herbert Spencer's Autobiography, *Science*, N. S., June 10, 1904, Vol. XIX., pp. 873–879; "The Sociology of Political Parties," *American Journal of Sociology*, January, 1908, Vol. XIII., pp. 439–454.

LINEAMENTS OF THE DESERT

By Dr. CHARLES R. KEYES
DES MOINES, IA.

OUR notions of the genesis of desert landscapes have lately undergone complete revision. In land-sculpturing under conditions of aridity we are led to recognize some entirely new phases of geologic operations. The principles deduced are not alone applicable to countries with excessively dry climates, but likewise to all lands of the earth.

In the moister regions of the globe, or those parts with which the majority of us are most familiar, moving water is so universally regarded as the chief agent of denudation that other erosive means are seldom more than barely considered. In the arid districts there is a reversal of the relative efficiencies of the erosion processes. Water-action is of quite secondary consequence. Wind-scour, or deflation, is not only the most vigorous, but often almost the sole, erosive power.

The tremendous efficiency of wind as an erosive agent has been lately brought to general notice mainly through the results of Passarge's investigations in the South African deserts. His principal deduction is far-reaching in its scope and significance, and seems destined to stand in geology as one of the grand generalizations of the new century. In our own country it opens up vast and fertile fields of geologic inquiry.

The desert regions of earth have given to modern geography its most suggestive and fundamental concepts. This is a fact that is all but forgotten by most of us who are accustomed daily to apply these basic principles in the more familiar moist tracts in which we live. Yet the definite cycle of evolution which land-forms pass through, the base-level to which all erosion tends, and a general plains-leveling, without regard to sea-level, that goes on in dry countries, are deductions of the desert.

True desert conditions prevail over a much larger proportion of our earth than most of us appreciate. Southwestern United States, the greater part of central Mexico, western South America, South Africa, northern Africa, southwestern, central and east-central Asia, eastern Europe and central Australia, all present vast areas of territory which have rain-fall insufficient to raise ordinary grain crops without artificial watering. The desert, however, is not the repulsive land that its name whenever mentioned suggests to the layman. Most of it is not

NAVAJO CHURCH, NEW MEXICO. Ponderous pinnacles of eolian erosion, rising nearly a thousand feet above the valley at left. (C. E. Dutton, photo.)

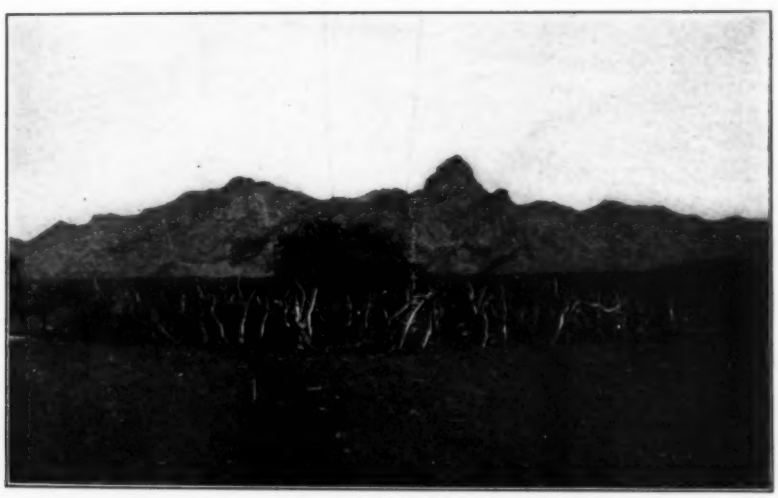
the barren waste of popular fancy. Vast tracts of it are certain to be reclaimed to the uses of mankind. Some of it is doubtless to become the most eagerly sought of all estates. Its beauties and its treasures are only beginning to be understood. Even scientists have only commenced to turn their attention seriously to the make-up, features and resources of the so-called desert regions.

The idea of a base-level of erosion, lying but slightly above tide, but below which stream-corrasion can not go, has done for geography what the principle of evolution has accomplished for biology. It is, in fact, the evolutionary principle applied to land sculpture. This theory of Powell's is justly regarded as one of the three grand deductions which geology of the century just past has bequeathed to science. Conceived midst the arid regions of the West, its widest influence has been in the moister countries of the earth.

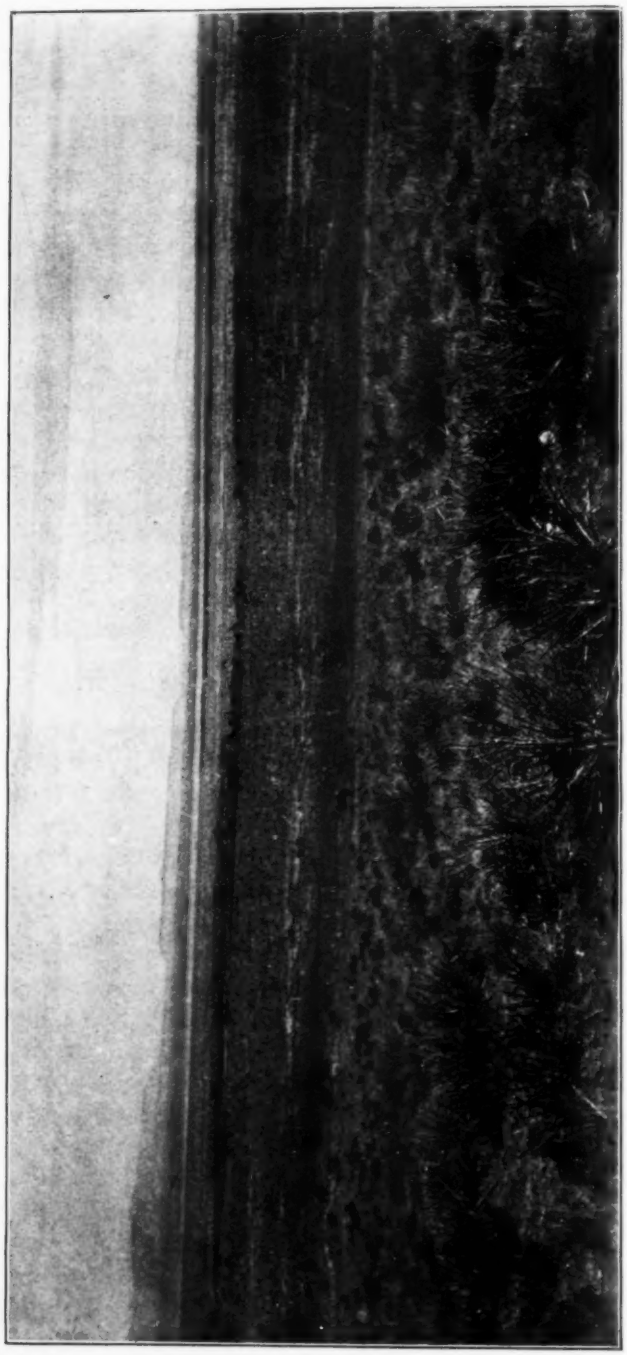
The second great geographic principle, that of the verity of a distinctly staged cycle of erosion comparable in a way to the periods of growth in the human individual, has done more than anything else to advance and place the study of geography on a truly genetic basis. It is to Davis we are chiefly indebted for devising for us a practical working scheme.

What the base-level of erosion is to the general theory of land degradation under conditions of a normal moist climate Passarge's great deduction of the possibility of general land leveling and lowering without regard to sea-level is to land sculpture under conditions of a dry climate. Until within the last lustrum the lineaments of the great desert regions of our globe have remained without adequate or satisfactory explanation. The genesis of the grander features of the landscape on the basis of ordinary tectonics, or of normal erosion during former wet climatic periods, or of water-action under present conditions, has always met with seemingly unsurmountable obstacles. The origin of the salient features of the desert, its peculiar mountains, its smooth plains, its strange plateaus, its streamless surface, its remarkable rock-floor, and its many other unexpected features, are only beginning to be fully appreciated in their proper relationships. To us of the moister countries they present many novelties. They make us acquainted with the vigorous workings of geologic processes to which we are as yet almost complete strangers.

In the operations of the geologic processes under conditions of an arid climate the most noteworthy effects as compared with those under normal conditions are the prevalency, the constancy and efficiency of



GHOST-LIKE DESERT RANGE OF BABOQUIVARI, ARIZONA. Central Peak is nearly a mile high and ten miles distant. (W J McGee, photo.)



PLAIN OF JORNADA DEL MUERTO, NEW MEXICO. A typical intermont plain of the desert. Mountain rim in background at left is 30 miles distant; that on the right 75 miles.

wind-scouring, the very subordinate, local and sporadic character of water-action, and the remarkable plains-forming tendency which deflative erosion effects.

Since most of our conceptions of landscape genesis are derived from our experiences in a normal moist or wet climate, the erosion agency with which we are best acquainted is running water. In the desert regions actually and necessarily water plays but small part in erosion. With less than ten inches of annual rainfall, most of which sinks into the earth as soon as it touches it, as in the dry regions of southwestern United States and the northern part of the Mexican tableland, or less than one inch as in the Nubian and Libian deserts of north Africa, the erosive influences of water must be all but a negligible quantity.

With water-action reduced to relative impotency in the desert region, wind-scour assumes a rôle the denuding power of which has been heretofore little considered. Its action is general and constant. Its effects are probably even more vigorous than the work of water under normal climatic conditions. In the effort to reduce the land surface to a low-lying plain the belts of hard and soft rocks are brought into somewhat stronger contrast than in the case when water is the chief agency of planation. The geologic structures are more sharply accentuated. The rock-floors are cleaner swept. The belts of weak rocks are faster removed. At all times the plain is more characteristically the main relief feature.

Contrary to popular belief the great desert tracts of the earth are mountainous regions. The mountain character has many novel and instructive peculiarities. Yet so dominant is the plains feature locally that the mountain ranges, bold and lofty as they often are, rise sharply from the level expanse as do volcanic isles out of the sea. So characteristic is this aspect that it is, in the South African deserts, appropriately denominated the "Inselgeberglandschaft."

In regard to the manner of their development the salient lineaments of the desert deserve much more attention than ever has been given them. They acquire new meanings when their peculiarities are considered in the light of an origin eolian in nature. Notwithstanding the fact that some of us, whose lifelong experiences have been mainly with the workings of the geologic processes in the moister parts of the globe, may find it a little difficult to fully appreciate at first the direct significance of many of the details of the relief features, a visit to the desert soon convinces us of their verity. There are at least a score of these physiographic characteristics of the dry lands that are especially striking.

The dominant feature of such desert regions as the western part of our own country and of Mexico is the interrupted plain the general surface of which is 5,000 to 7,000 feet above the sea. Out of it rise

abruptly the numerous mountain ranges to like heights above the plains-surface. Of this region four fifths are plain; one fifth highland. The vastness and evenness of the intermont plains is a matter of much speculation with all who travel the region, scientist and layman alike. Extensive desiccated lake-bottoms they are usually regarded. They are sometimes considered to be intermont basins deeply filled with wash from the peripheral highlands. At the present time the only adequate explanation of their physiognomy is that they are fashioned mainly by eolian agencies with some slight modification by water.

The complete isolation of the different mountains is one of the most remarkable facts concerning the desert features. In most parts of the world there is some more or less close structural relationship between neighboring mountains which are often united to one another by foot-hills. In the desert there is no such tectonic connection. The mountain ranges are all independent individuals without relationship of any kind to one another. Structural mountains, volcanic mountains, laccolithic mountains, fault-block mountains and high residual plateau mountains are neighbors distinctly separated by stretches of level plain.

Mountain ranges throughout the dry regions of western America are completely and evenly surrounded by level plains as if by the sea. They are numerous, short and narrow. Upon the map Dutton has likened them to an army of caterpillars crawling northward out of Mexico, dividing as it enters the United States, the main body turning

GREAT POSO VERDE PLAIN. Isolation of the mountains, sharp meeting of plain and mountain, and absence of foothills are noteworthy characteristics.
(W J McGee, photo.)

COYOTE MOUNTAIN, ARIZONA, rising 3,000 feet above the plain. Devoid of soil; impotency of water-action shown in the small volume of fans at the base.

westward and then northward again until it passes into the British possessions. The simile is as striking as it is apt.

To the average mountaineer, one of the strangest characteristics of the desert ranges is the absence of foot-hills. The main eminences of the mountains rise directly from the plains. The line where plain and mountain meet is as sharply defined as if drawn with a pen. Often this line is represented by high mural faces that can be scaled at but few points. For this reason it is, chiefly, that the mountains appear to be half buried by the drifting sands. It is on this account largely that the plains areas appear to be leveled by the waters of former seas, of which the mountains formed the coastal cliffs. The illusion is all but completed by the fact that the phenomenon is perfectly independent of geologic structure. This surprising feature is really one of the most novel peculiarities of eolian action under conditions of aridity.

That the substructure of the intermont plains is made up of the softer or non-resistant rocks is an observation the full significance of which has been only lately appreciated. Under conditions of a moist or wet climate it is not an unlooked-for fact that the belts of weak rocks coincide with the valleys or lowlands. It is unexpected, however, that this is also true in an arid country, especially since the intermont plains are commonly considered as areas of extensive accumulations of mountain waste. On the whole they are now thought to be areas of

most rapid degradation. The much stronger contrasts of belts of soft and hard rocks observable in the arid lands than in the moist lands appear to be due to this very fact. Then, too, wind-scour and not water-action must be reckoned with as the main erosional means, another fact that has not been usually taken into account.

Without exception the mountain rocks of the western deserts are very hard and resist the attacks of erosive action to an eminent degree. The plains rocks being mainly non-resistant rocks, as we have seen, there thus appears a notable alternation of hard and soft rock-belts. In the geologic succession the rocks composing the mountains are principally ancient crystallines and Paleozoic limestones which are followed by enormous thicknesses of soft sandstones and shales that frequently

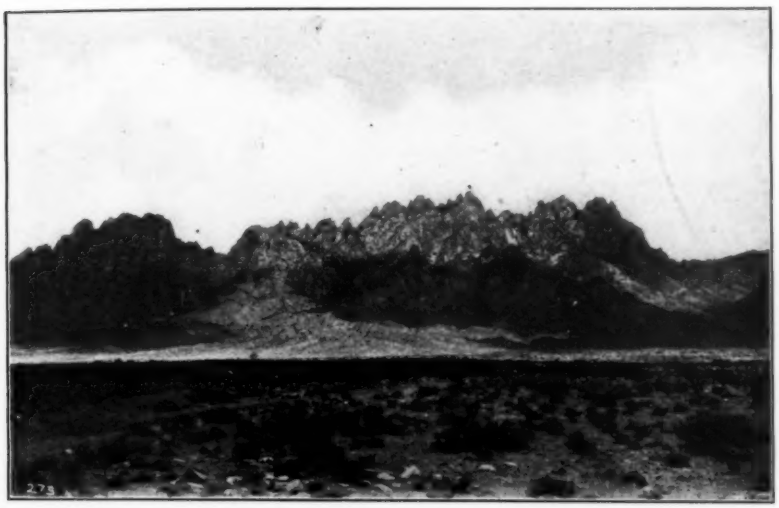
SIERRA OSCURO, NEW MEXICO. Rises out of plain like a volcanic isle out of the sea; height 4,000 feet; distance 15 miles. It is composed of hard rock; the plain of soft sandstones.

attain a vertical measurement of 10,000 feet or more. Tertiary faulting on a grand scale has brought the soft strata to the same level as the resistant beds. In the general and profound wearing down of the surface of the country towards sea-level, marked contrasts of relief are produced between the various rock-belts. In the moist countries the isolated residual eminences of general erosion, known to geographers by the special name of monadnocks, after the New England mountain regarded as the type, are of rare occurrence. In the desert region the majority of the mountains are of this character.

One of the most peculiar of the many odd features of the desert is the beveled rock structure of the plains-surface. In the moist regions a high-lying plain with the substructure beveled is taken as an indication of former peneplanation, the lowest level to which water can wear

down the land. The intermont plains of the arid region of western America have beveled rock-substructures, but their surfaces are 5,000 to 8,000 feet above sea-level. The beveled character of the strata is almost conclusive evidence that these plains are not areas of extensive aggradation. In the absence of adequate water-action their origin must rest mainly in long-continued and effective deflation.

Critical examination of the substructure of the plains, in favorable places, shows clearly that the rock-floor itself is a plain. Although not always apparent at first glance this rock-floor is commonly only thinly mantled by wash débris and soil. Hence the rock-floor and the present plains-surface are not very different in their detailed relief characters.



SIERRA ORGANO. Striking example of absence of rock-weathering in arid country; the peaks rise 5,000 feet above the plain.

A phenomenal feature of the desert plains is the plateau-plain. Mesas they are called in southwestern United States and Mexico. These mesas, as their Spanish name signifies, are extensive, flat-topped, table-like areas rising abruptly from the general plain to heights of from one or two hundred feet to a thousand feet or more. The great Mesa de Maya, in northeastern New Mexico, is 3,500 feet above the next lower plain.

The surface of the plateau-plain is usually found to be composed of some hard rock layer, as in the case of the vast Llano Estacado, or "walled plains," or staked plains as it is called by the Texans; or is made up of an extensive lava flow, as, for example, the Mesa de Maya, the Ocate mesa and the majority of the plains of this kind. The surface beneath the lava flows of the mesas is itself a plain worn out on

FISHER PEAK, A SPUR OF THE MESA DE MAYA, COLORADO. It is 15 miles away and nearly 4,000 feet above the plain in foreground; a fine example of the plateau-plain.

the beveled edges of the strata. The plateau-plain thus represents a former position of the general plains-level. It is the best example of circumdenudation through vigorous wind-scour.

The soil mantle of the intermont plains is everywhere relatively thin. These plains instead of being areas of great accumulations of recent rock-waste, as might very naturally be expected, appear to be, as a rule, only thinly veneered. Often extensive areas are swept clean by the winds so that the rock-floor is exposed.

Nearly all of the finer surface detritus is transported from a greater or less distance. It is rare for the surface materials of the desert plains to give any suggestion of the rock-composition immediately beneath.

The gravely character of the intermont plains of the desert, to which travelers commonly allude, is largely only apparent. Most of the gravel-surfaced areas when upturned by the plow give excellent loamy fields. It is not generally recognized that the great abundance of pebbles on the surface of many plains is due to the fact that the strong and persistent winds blow away the finer materials, leaving a pebble mosaic behind.

While the rock-floor of the plains is itself a plain there are many inequalities in the surface. Between sheet-flood erosion and wind-drifted sands all local depressions are quickly filled. The tendency of the surface mantle is thus merely to make the plains smoother than they otherwise might be.

One of the most remarkable features which at once attracts the attention of the traveler is the general absence of distinct waterways in the valleys or intermont basins. Notwithstanding the fact that the gradients are high, no drainage systems are developed. Channel-ways that are corraded by unusual freshets, which sporadically occur, are quickly obliterated by the drifting sands and soils.

The degradation of the desert regions is not to be regarded as all accomplished by wind-scour. At times water plays a minor but important part locally. In the loftier mountain ranges normal torrential water-action takes place, much the same as it does in humid regions. The streams which are occasionally formed by heavy rainfalls soon sink into the ground on reaching the plain and become lost rivers. At other times, the stream-ways are without water for the greater part of their courses; arroyos, or dry creeks, the Spanish term them. McGee's vivid description of the advance of a flood-sheet over a piedmont slope is in reality the running of an arroyo as it enters a plain.

Water sometimes assumes another strange phase. The excessive local rainfalls which occur at rare intervals, "cloud-bursts" they are called, often form in the intermont valleys extensive shallow lakes. Most of these bodies of water are of short duration. When they are

so situated as to be periodically renewed for a part of each year the areas become vast mud-flats, forming the playas of the Mexicans. Notwithstanding the fact that most of these lakes are ephemeral in character, they are sometimes long-lived. In the valley of the Rio Conchos, in the state of Chihuahua, the rainfall was once so heavy that in a single night a great lake was formed that lasted for more than eighty years.

A most singular phenomenon resulting directly from water-action in the desert is sheet-flood erosion. The vigor with which it often acts makes it locally an important plains-forming agent. Instead of the water from the rainfall tending to concentrate along certain lines of lowest level, as in humid regions, it spreads out over the sloping plains-surface. The railroads crossing the desert have yet to discover an effective method to overcome the disastrous work of the flood-sheet.

In the desert, however, extensive water-action is exceptional and relatively unimportant.

Not the least striking characteristic of desert regions is the marked absence of rock-weathering as we ordinarily know it. All exposed rock surfaces present an aspect of wonderful freshness. Chemical decomposition of rock-masses is all but unknown under the influences of a dry climate. The breaking down of the rocks is mainly mechanical, assisted somewhat by sand-blast action.

During the next decade the features of the arid portions of our earth promise to give us many novel ideas concerning the workings of certain of the geologic processes. To the scientist the desert will become one of the most interesting fields of research.

ON THE THERAPEUTIC ACTION OF FERMENTED MILK

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DURING the past year there has been in the United States a large increase in the use of fermented milk in the treatment of disorders of digestion and nutrition. A clearly discernible influence in bringing about this increase lies in the publications made by Professor Metchnikoff and his colleagues in reference to the fermented milk known as lacto-bacilline. The statements made by these scientific workers have been repeatedly exaggerated by persons having a commercial interest in the sale of certain kinds of fermented milks. It is apparently true that many physicians have been influenced by these statements in the direction of recommending among their patients a much wider use of fermented milk, and especially of lacto-bacilline, than was previously the case. Moreover many persons have decided without the advice of a physician to make a trial of some form of fermented milk or of some form of lactic acid ferment capable of acting upon milk sugar. It appears that this dietetic practise is still on the increase and likely to modify the habits of a not unimportant part of the community in respect to diet. In view of this fact it seems to me desirable to consider from a critical standpoint the therapeutic effects supposed to be derivable from the use of fermented milks, and more especially from milk that has been fermented through the use of the *B. bulgaricus* recommended by Professor Metchnikoff and now widely employed in the production of lacto-bacilline. I believe that at the present time there exists a considerable confusion of mind as to what may or may not reasonably be expected in the way of therapeutic results from the use of milk which has undergone lactic acid fermentation. It is the object of this paper to consider briefly the elements which should enter into the formation of a judgment as to the therapeutic efficacy of lacto-bacilline and allied milk products.

In order to be able to form an unimpeachable judgment on the therapeutic action of a fermented milk, it is necessary that experiments of a very painstaking sort should be carried on in a number of individuals for considerable periods of time. Experiments of a kind calculated to furnish a firm scientific foundation for a rational use of fermented milks have not yet been made. Such experiments in order

to be decisive would have to be conducted not merely on people in good health, but also on a suitable variety of digestive and nutritional disorders in which the bacterial conditions in the intestine, the state of metabolism and the general conditions of life are taken into account with the greatest care and judgment. Although I have for many years been interested in watching the influence of fermented milk on the human organism in various states of digestive derangement, and have accumulated many observations bearing on the question, my experience falls far short of what is necessary to establish final conclusions. In this communication, therefore, I do not offer any solution of the therapeutic problems pertaining to the use of fermented milks, but seek only to discuss critically, in the light of such information as now exists, some of the claims that have been made for the employment of these kinds of milk. I do this with the thought that a discussion of the various elements which should enter into the formation of a judgment regarding the therapeutic value of milk subjected to lactic acid fermentation may prove helpful to those who have not given the subject much personal study and are therefore unable to analyze the problem in a way that is likely to serve as a practical guide.

There are five important kinds of effects referable to the action of fermented milks which must be considered in any judgment of the therapeutic effects of a milk which has undergone lactic acid fermentation. These are, first, the effects on the absorption of fats and proteins; secondly, the effects due to reduction of carbohydrates; thirdly, effects due to the presence of lactic acid; fourth, effects due to the bacteria used in lactic fermentation; fifth, effects due to a lowering of putrefactive decomposition. These latter effects, which are of the first importance in connection with any study of the action of fermented milk, are of course not entirely distinct from the others just mentioned, but stand related to each of these other factors. Owing to their prominence, however, it is desirable that they should be separately considered.

At present the influence of lactic acid fermentation upon absorption of the milk constituents is but little understood. The question relates especially to the absorption of fats and of proteins, for the carbohydrates of the milk are in large degree removed by the fermentative process, lactic acid, carbon dioxide and alcohol being the chief constituents resulting from the breakdown of the milk sugar. It is important that we should obtain exact data with regard to the absorption both of the fats and of the proteins, but, so far as I am aware, these do not at present exist. If it could be shown that the absorption of milk fat and of milk proteins is increased in health through the influence of lactic acid fermentation of any kind, this would be a distinct argument in favor of the use of such milk as an article of diet,

since it would make for economy in the administration of the machinery of the body. Equally important and desirable are reliable observations on the effect of fermented milks on the absorption of milk fats and milk proteins in various types of intestinal infection with their accompanying acute and chronic catarrhal inflammation of the mucous membranes of the digestive tract. The therapeutic claims put forward by enthusiastic advocates of the use of fermented milk have in general taken a different direction and have concerned themselves much more with the question of the reduction in intestinal putrefaction than with increase in absorption. But it must not be overlooked that an improved absorption of proteins is one of the most important conditions in general for reducing intestinal putrefaction, because whatever favors prompt and complete absorption must correspondingly limit the opportunity for decomposition. In a lesser degree this statement holds true also of the fats. I have been able to show experimentally that in normal persons the butter-fat may be much increased above the usual intake—say from fifty grams to one hundred and fifty grams daily—without materially increasing putrefactive decomposition. On the other hand, such an increase in butter-fat in persons already suffering from increased putrefactive decomposition shows a pronounced tendency to still further increase the putrefaction. I attribute this tendency to the mechanical obstacle to prompt absorption of proteins arising from the presence of fat in abundance. The failure in prompt absorption of proteins from an intestine infected with putrefactive microorganisms means intense putrefaction, whereas a similar failure in a healthy intestine is far less significant owing to the relative infrequency of putrefactive bacteria.

In considering the therapeutic influence of fermented milk, it is necessary to take into account the fact that in such milk the carbohydrate material has been in a large degree replaced by the products of fermentation. Where milk is used in only small amounts in the dietary, and these small amounts are replaced by a fermented milk, the difference in quantity in respect to the intake of carbohydrates may be so small as to be negligible. Where, however, the dietary consists largely of milk and this large amount of milk is replaced by an amount of fermented milk equivalent in protein and in fat, the difference in respect to the carbohydrate material may assume considerable importance. In the case of the unfermented whole milk, there is enough milk sugar to markedly encourage fermentative decomposition in the intestine with the production of considerable gas. The gas-forming organisms especially likely to attack the milk sugar are *B. lactis ærogenes, B. coli* and *B. ærogenes capsulatus* (*B. welchii,* or *B. perfringens*). In cases where there is marked flatulence from the use of whole milk, the use of any fermented milk in which the milk sugar

has been largely destroyed by fermentative bacteria introduces conditions unfavorable for intestinal fermentation. I consider that the diminution in fermentable material thus arising from the decrease in the carbohydrates of the milk is an important factor not merely in reducing intestinal fermentation, but also in reducing intestinal putrefaction, for it is true that in some intestinal infections in which we are justified in assuming that the colon bacillus or *B. ærogenes capsulatus* or both these organisms have extended in an upward direction toward the stomach, the abundant presence of fermentable carbohydrate pabulum leads to a great increase in these microorganisms. After the absorption of the acid produced in the course of this fermentation there may be established a neutral or even an alkaline reaction in the lower part of the small intestine and in the colon. In the absence of acid and indeed in the presence of a moderate amount of acid, the colon bacilli and *B. ærogenes capsulatus* are capable of making an increased attack upon the protein material. This increases intestinal putrefaction. On the other hand, the irritation arising from organic acids formed in the small intestine and stomach often leads to a fermentative diarrhœa.

Turning now to the effects attributable to the presence of lactic acid in the soured milk, it is at once apparent that we have to distinguish clearly between the action of such preformed lactic acid as may be introduced with the milk and such acid as may be formed in the course of further lactic acid fermentation after the soured milk has been ingested. The essential difference lies in the fact that such lactic acid as is preformed in fermented milk is liable to be absorbed from the upper part of the small intestine, whereas if lactic acid fermentation goes on within the digestive tract, the acid may be formed at any level of the intestine. In the former case the action of the acid is to be regarded as largely limited to the portion of the intestine in which putrefactive decompositions seldom occur; in the latter case there may be production of acid within the territory in which putrefactive decompositions are apt to take place. We should therefore expect greater anti-putrefactive efficacy from the use of soured milk containing living lactic acid producers than from the same milk after sterilization. Whether such a difference as this is actually discernible in practise I am unable to say, as I am not aware of the existence of satisfactory experiments made to test this point.

As to the efficacy of lactic acid as an anti-putrefactive agent it is necessary to speak with caution. It has been the practise of many physicians to employ lactic acid in the treatment of disorders of digestion, especially those of infancy. But I am unaware that we have adequate data for the establishment of the therapeutic anti-putrefactive value of lactic acid. Where the stomach secretes no free hydrochloric

acid it is reasonable to suppose that the use of lactic acid in weak concentration exerts some anti-fermentative action, especially against such microorganisms as do not readily grow in acid medium. But there are many kinds of microorganisms in the digestive tract which are resistant to the action of lactic acid in the low concentration which can be tolerated by a somewhat irritable mucous membrane. Most yeasts and some important intestinal bacteria, such as *B. lactis ærogenes, B. bifidus, B. infantilis* and various organisms classed at acidophiles, have this property. It is a fact little known that some of the coccal organisms of the intestine resist the action of acid in a remarkable measure. It is therefore quite clear that anything approaching a significant modification of the activities of organisms of the types just mentioned is not to be looked for through the use of lactic acid. Moreover, I have shown that a considerable grade of acidity in the intestinal tract is consistent with very active fermentative growth of *B. ærogenes capsulatus.* This organism forms butyric acid during the fermentation of carbohydrates, together with only small quantities of lactic acid, and there is no reason to suppose that its development in the intestine is materially inhibited by any concentration of lactic acid which is likely to be obtainable in the lower part of the small intestine or in the colon, either as the result of administering lactic acid or in consequence of the use of soured milk.

That a considerable or high degree of putrefactive decomposition in the intestine is not controllable in man by the administration of moderate doses of lactic acid has become plain to me as the result of clinical observation. And that even very large doses of lactic acid are unable to restrict intestinal putrefaction is rendered highly probable from experiments made in my laboratory by Dr. Helen Baldwin. In dogs taking a meat diet and excreting urine characterized by abundant indican and high ethereal sulphates there was no falling off in putrefaction as a result of administering doses of lactic acid as large as five grams daily. It seems to me doubtful if under these circumstances enough lactic acid could reach the large intestine to exert even a moderate anti-putrefactive action. The experiments just mentioned represent an extreme case, since they were made on animals living exclusively on meat. The results obtained can not, therefore, be regarded as strictly applicable to man. Nevertheless these experiments are instructive as indicating the inefficacy of large doses of lactic acid in controlling intestinal putrefaction where the conditions for such putrefaction are favorable and where the acid is given under conditions rendering likely its absorption in the upper part of the digestive tract.

That the presence of lactic acid in soured milk does not necessarily exert a significant anti-putrefactive action in the large intestines is clearly shown by the observation which I have several times made that

persons suffering from chronic intestinal putrefaction have shown no diminution in the putrefactive products excreted in the urine where the patients have added a soured milk to their usual diet. It is, of course, clear that in cases of this sort the failure of the putrefactive process to decline may be attributable to the introduction of more than the habitual amount of protein material. The observation is, however, of interest in that it emphasizes the fact that the ingestion of lactic acid, even if probably associated with lactic acid fermentation within the intestine, may not suffice to exert any beneficial influence in reducing putrefaction.

I do not wish to be understood as maintaining that the presence of lactic acid in soured milk is of no value in checking intestinal putrefaction. I wish merely to point out that the administration of lactic acid *per se* can not be regarded as a significant anti-putrefactive procedure. It seems to me probable, on the other hand, that the presence of lactic acid in the large intestine would at least in a degree tend to restrict putrefactive decomposition. But I must own that positive evidence on this point seems to be at the present time entirely wanting. In my judgment only very carefully planned studies would suffice to enable us to form a final opinion on the value of lactic acid as an anti-putrefactive agent. We are not justified in developing an enthusiastic attitude toward lactic acid as an agent in the inhibition of intestinal putrefaction on the basis of our present knowledge.

Let us now consider the effects derivable from the bacteria used in lactic fermentation. As an example of a strong lactic acid producer we may take *B. bulgaricus,* used in the production of lacto-bacilline. This organism is a powerful lactic acid ferment, forming large amounts of lactic acid from milk sugar while forming very little alcohol. The organism grows well in milk and on some media containing an abundance of soluble carbohydrates, as, for instance, in malt extracts. We may take the behavior of *B. bulgaricus* in the digestive tract as being typical of efficient lactic acid bacilli in general. There are two questions which we must put to ourselves regarding the therapeutic effects of such bacteria. First, to what extent do the lactic acid bacilli replace obligate normal types of bacteria or the undesirable saprophytic forms present in disease? Secondly, to what extent is it desirable that there should be a replacement of the intestinal flora by lactic acid bacilli?

It is one of the fundamental assumptions of the sour milk treatment of intestinal diseases that the lactic acid producing microorganisms establish themselves throughout the digestive tract and through their more or less aggressive growth directly or indirectly inhibit the development of putrefactive or other undesirable forms of bacteria. In some of the statements put before the public in regard to the action

of the lactic acid bacilli it is claimed that they drive out other forms of bacteria from the large intestine, the chief seat of intestinal putrefaction. It is desirable that we should soberly consider the known facts relating to this question. I think it safe to say that the ability of lactic acid forms to replace or dominate other types of bacteria in the large intestine is much exaggerated. I have devoted some study to this question, especially in the case of the *B. bulgaricus* employed in the production of lacto-bacilline. This organism, owing to its large size, morphology and cultural peculiarities is easily recognized and is cultivable, from the intestinal contents. When given to human beings in the large numbers present in lacto-bacilline it can after a few days' administration be cultivated without difficulty from the movements. Even when large quantities of the fermented milk have been taken I have not found that it becomes the dominant organism, although it may be present in moderate numbers. On stopping the administration of the lacto-bacilline, the *B. bulgaricus* generally disappears in the course of a few days, showing that it has not permanently established itself within the intestinal tract. There may be exceptions to this statement, but I have not yet met with any. These clinical results are quite in accord with those obtained by Dr. Kendall and myself in experiments upon a monkey fed for two weeks on lacto-bacilline exclusively. At the end of this period, when the movements were showing the regular presence of *B. bulgaricus* in relatively moderate numbers, the animal was killed and the digestive tract examined with care at all its levels. The lactic acid organisms were found in greatest abundance in the small intestine. In the lowest portion of the small intestine a notable falling off was observed and other types of bacteria were prominent. In the large intestine the numbers were only moderate as compared with other varieties of bacteria, thus clearly showing that in this instance, at least, the *B. bulgaricus* was very far from dominating other associated types of bacteria. I consider this fact noteworthy, as the experiment was carried out under conditions highly favorable to the establishment of the lactic acid bacilli in the digestive tract. The large number of microorganisms given and the relatively short extent of the digestive tract in the monkey should, it would seem, provide conditions for the adaptation of the organisms throughout the alimentary canal.

It is probable that the experience just recounted with regard to lactic acid bacilli is not at all exceptional, or in other words that foreign bacteria in general find it difficult to gain a permanent footing in the digestive tract. The literature of experimental bacteriology shows this to be the case. Personal experiments made with a highly fermentative putrefactive organism—*B. ærogenes capsulatus* (*B. welchii* or *B. perfringens* of the French writers)—in feeding experi-

ments on monkeys showed that in health these animals have the power of very quickly ridding themselves of this variety of bacteria. Experiments now under way with a microorganism described by myself and Dr. Kendall as *B. infantilis* and found very abundantly in some of the digestive diseases of children, show the same thing to hold true.

The fact that *B. bulgaricus* does not readily gain a dominant position in the digestive tract in man or in the monkey has an obvious bearing on the results to be expected from its therapeutic use. If it be indeed true that *B. bulgaricus* is capable by its presence in the intestinal tract of inhibiting undesirable types of bacteria and especially the microorganisms concerned with intestinal putrefaction, then it must be equally true that the difficulty in obtaining a dominant and permanent foothold in the intestinal tract is a fact with which we must reckon in any estimate of the results likely to be obtained through the administration of these organisms. The moderate representation of *B. bulgaricus* in the large intestine after the free administration of lactobacilline is surely something very different from what has been already frequently pictured by the enthusiastic upholders of the use of this form of fermented milk in the treatment of diseases of the digestive tract.

I think it has been assumed with far too little reason that the dominant presence of foreign microorganisms of the lactic acid group is necessarily a desirable thing. If it could be shown that lactic acid bacilli, such as *B. bulgaricus* or certain varieties of *B. acidi lactici,* have the faculty of replacing undesirable forms of microorganisms such as the bacilli of typhoid or of paratyphoid fever or putrefactive microorganisms, such as *B. proteus vulgarus* or *B. ærogenes capsulatus,* this would undoubtedly be cause for congratulation, especially if it could be shown at the same time that the normal flora of the digestive tract remained unchanged. I do not deny the possibility that this selective kind of anti-bacterial action may some day be proved to exist. I desire merely to point out that at present I know of no facts to justify us in believing that such antagonistic action as the lactic acid bacteria may possess is directed solely against the disease-inciting invaders of the digestive tract. If it should prove true that the antagonism exerted by the lactic acid bacilli against injurious invaders is also exerted against the obligate bacterial inhabitants of the alimentary canal, such as *B. coli communis* and *B. lactis ærogenes,* I am by no means convinced that this could be regarded as a point in favor of the prolonged therapeutic use of lactic acid bacilli. If, as appears to be true, these obligate inhabitants of the digestive tract are especially adapted to the normal conditions of secretion and digestion in the human intestine and tend to be suppressed in some serious conditions of the digestive tract (while their reappearance and reestablishment in abundant numbers

is one of the first, most definite and most reassuring signs of improvement in the clinical condition of certain kinds of patients) to make use of any mode of lactic acid bacillus therapy which will inhibit the normal development of *B. lactis ærogenes* or *B. coli communis* in the digestive tract would, in my judgment, be a profound error in principle. I do not wish to intimate that I consider *B. bulgaricus* or any of the common lactic acid bacilli to be capable of seriously checking the growth of *B. lactis ærogenes* and *B. coli communis* in the digestive tract, but wish to state that in so far as such modification is possible it appears to me not without undesirable features. To the validity of this statement there is one possible exception that occurs to me. In cases where there is a colon bacillus infection of the intestine, that is to say, an inflammatory state associated with a great over-growth of *B. coli,* the antagonistic influence of lactic acid bacilli might be useful. But I am not sure that this is more than a merely apparent exception to the general rule which I have above expressed as valid, for it is not clear that it has been proved that the colon bacilli apparently answerable for digestive infections are in reality the normal colon bacilli. It appears to me more likely that they are commonly variants of such bacilli whose fermentative characters have not yet been determined fully and precisely.

I would also mention here the fact that there are diseases of the intestinal tract associated with the presence of bacteria capable of forming lactic acid. Obviously, then, this property of a microorganism does not necessarily screen the digestive tract from injury.

One of the most important and most loudly heralded effects of the administration of soured milk is that on intestinal putrefaction. Under conditions of health the putrefactive decompositions in the intestinal tract seldom attain a considerable degree of intensity—a surprising fact when we consider the immense numbers of bacteria which inhabit the large intestine. In many pathological states the conditions of putrefaction in the intestine are very much altered in the direction of great intensification. This is shown both by the dominance of putrefactive microorganisms in the large intestine and by the appearance of products of putrefaction in the urine. It is unnecessary here to discuss the nature of these products. It should, however, be pointed out that the intensity of putrefaction as judged by the quantity of putrefactive products in the urine is notably influenced by the quantity of protein material ingested. We may say that in general a considerable increase in the protein intake is followed by a corresponding increase in putrefaction and that a marked diminution in protein intake is followed by a distinct falling off in putrefaction. This statement holds true in general in conditions of health and it is even more strikingly exemplified in cases of chronic intestinal infection associated

with habitual excess in putrefaction. In view of this fact it is clear that in experiments designed to determine the influence of fermented milks upon the intensity of putrefaction it is essential to take accurate cognizance of the quantity of protein ingested. It is easy to understand that if a patient has been in the habit of eating for his midday meal an abundance of protein food and decides under advice to take a fermented milk for his lunch in place of the more elaborate meal, the mere reduction in protein will suffice to reduce putrefaction. So it is clear that a decrease in putrefaction can be effected through a variety of dietaries which have in common the fact that they contain a smaller amount of protein material than the patient has been in the habit of eating. Whole milk and various fermented milks are thus capable of influencing putrefaction in such a way that we may readily fall into the error of exaggerating their influence upon putrefactive decomposition in the intestine. Hence it is evident that the only fair test of the value of a fermented milk in respect to its influence on putrefaction is to compare it with the effects of other articles of diet containing exactly the same amount of protein material. Such careful comparisons have not, I believe, been made up to the present time. In the future they will doubtless be made and will enable us to form quite definite judgments as to the relative effectiveness of different kinds of fermented milks upon intestinal putrefaction. At present I should hesitate to say that one kind of fermented milk is more effective than another in bringing about a reduction in intestinal putrefaction.

We may regard it as well established that a diet in which milk takes the place of other kinds of food is very apt to be followed by a reduction in the intensity of putrefactive decomposition in the intestine. There are, however, clinical indications that the use of fermented milks does possess real advantages over the use of whole milk at least in some disorders of digestion. Although the exact character of these advantages is not yet firmly established, they seem to be none the less real. From what has already been said in this paper on the criteria of judgment of the action of fermented milks, it is evident that the clinical advantages which have been observed may be attributable to several different peculiarities possessed by fermented milks in general. One of these is the favorable mechanical influence on the minute subdivision of the casein, which prevents the undesirable effects associated with the presence of large clots of casein which are not easily disposed of in persons with weak digestion. The exact consequences of this advantageous mechanical state of the milk food can not now be appraised. A second point which has already been mentioned is the formation of lactic acid. Here again the precise extent of the favorable influence can not be measured; but on the other hand it can not be denied that in at least some disorders of digestion the presence

of lactic acid in the intestinal tract may exert a degree of anti-putrefactive action. It should, however, be remembered that there are persons with chronic inflammatory states of the digestive tract who tolerate very badly acids of all sorts. These persons are unable to take considerable quantities of fermented milk if the milk contains a high percentage of lactic acid, the attempt to utilize such food being followed by various unpleasant sensations and diarrhœa. The possible anti-putrefactive influence of the presence of living lactic acid bacilli in various parts of the digestive tract has already been discussed at sufficient length and it has been pointed out that this factor again is one whose value can not at present be accurately estimated.

It must be plain from what has been said that the therapeutic use of fermented milks rests at the present time rather more securely on the clinical observations that have been made with it than on an adequate scientific study of the influence exerted upon digestion and nutrition and especially on the processes of putrefaction. To obtain the necessary scientific data will require elaborate and very laborious experiments covering long periods of time. With the aid of such experiments I have no doubt that the usefulness of soured milks in health and in disease will be definitely and discriminatingly established. The limitations of utility will become equally plain, and I predict that they will prove to be many. The importance of this subject for the welfare of people at large not only in respect to immediate physical comfort and efficiency but as regards the prolongation of life, would, in my opinion, amply justify a very considerable expenditure of money to acquire this knowledge.

It can not be regarded as surprising that the enthusiasm which has been aroused partly through the public exploitation of various kinds of fermented milk in the treatment of disease and partly by the undoubted successes of the treatment should have led to various abuses. One of the most important things to understand in reference to the use of fermented milk is that it should be employed in most instances as a substitute for other forms of food rather than as an addition to the usual dietary. Especially is it necessary to bear this in mind in the case of chronic disorders associated with an increase in putrefaction. The addition of a considerable amount of fermented milk to the habitual dietary has often been practised with disastrous results, and I do not doubt that this practise is still widely extended. Such bad results might be predicted, for since all fermented milks contain a large proportion of protein material capable of undergoing putrefaction and since this putrefaction is not checked, in any specific way, through the agency of the fermented milk itself, a great increase of putrefactive decomposition may follow the injudicious excessive use

of such food. I have seen several instances of this error, which is not confined to laymen, but is sometimes committed by physicians also.

Another feature of fermented milk which needs to be closely scrutinized is the character of the microorganisms employed as ferments of the milk. In a few instances I have known to be used as ferments what I believe to be very undesirable types of bacteria. I think it may be said that most of the fermented milks on the market in this country at the present time contain chiefly fermentative organisms which are harmless when not excessively administered. In some cases the lactic-acid producing bacteria have become contaminated by possibly undesirable yeasts. It is only natural that accidents of this sort should occur in what is comparatively a new industry, and it is likely that with increasing experience the manufacturers of the various fermented milks will be compelled to exercise every reasonable caution in regard to the purity and quality of the ferments employed in their products.

The use of tablets of other preparations of lactic acid bacilli is now becoming widespread. The tablets are taken with some carbohydrate material which will permit the growth of the bacteria and the formation of lactic acid. I have seen good results from this method of using lactic acid bacilli, in the relief of symptoms referable to excessive intestinal putrefaction. But I do not think the data exist at present for an intelligent comparison of this use of lactic acid bacilli with their use in fermented milks. I hope before long to be able to discuss this question on the basis of experimental observations.

POETRY AND SCIENCE: THE CASE OF CHARLES DARWIN

By EDWARD BRADFORD TITCHENER

IN the autobiographical chapter of the "Life and Letters of Charles Darwin" occurs a well-known passage, in which the writer deplores his loss, in middle life, of the higher esthetic tastes.

> Up to the age of thirty, or beyond it, poetry of many kinds, such as the works of Milton, Gray, Byron, Wordsworth, Coleridge and Shelley, gave me great pleasure, and even as a schoolboy I took intense delight in Shakespeare, especially in the historical plays. . . . But now for many years I can not endure to read a line of poetry: I have tried lately to read Shakespeare, and found it so intolerably dull that it nauseated me. . . . This curious and lamentable loss of the higher esthetic tastes is all the odder, as books on history, biographies, and travels (independently of any scientific facts which they may contain), and essays on all sorts of subjects interest me as much as ever they did. My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone, on which the higher tastes depend, I can not conceive. A man with a mind more highly organized or better constituted than mine would not, I suppose, have thus suffered; and if I had to live my life again, I would have made a rule to read some poetry . . . at least once every week; for perhaps the parts of my brain now atrophied would thus have been kept active through use. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature.

The loss which Darwin here regrets has often been charged to the particular account of his occupation with science. I have always believed that the charge is unfounded. It is difficult to give precise reasons, to translate into words what is, at bottom, a matter of general cumulative impression; but I shall attempt to show that there are, at any rate, plausible grounds for doubting the common construction put upon his remarks.

I must begin by saying that there is no real evidence to the effect that Darwin showed, at any period of his life, a deep feeling for poetry, or a profound understanding of it. I use the adjectives advisedly. The true love of poetry, and the intimate understanding of poetry, are matters primarily of a man's temperament. But they are also, like everything else that is worth while, largely—much more largely than is ordinarily supposed—matters of technique, of long and studious apprenticeship. Temperament and training, then, must go

together, if anything more than superficial interest is to result. Now Darwin's temperament was scientific: "My love of natural science," he writes, "has been steady and ardent." I suggest that the combination in a single individual of the scientific and the poetic temperaments is and must be rare. And I suggest, further, that, where it occurs, the temperament will almost inevitably develop one-sidedly, so that poetry outtops science, or science poetry.

In Goethe's case, poetry was in the ascendent. As I said above, I do not think that Darwin had any large admixture of the poet in his make-up; certainly not so large an admixture of poetry as Goethe had of science. But I believe that he had something of the poet in him; I believe that the atrophy of this something went less far than he himself imagined; and I believe that science is not specially responsible for its partial loss.

Every normal man is a poet for a few years of his life. With most of us, the poetic interest and inspiration die out, as naturally and almost as suddenly as they came, somewhere about the age of twenty-five, and usually sooner rather than later. Darwin was a man of genius, and like many other men of genius he came late to maturity; his plastic period extended, as he himself declares, "up to the age of thirty or beyond it;" and the "Origin of Species" was published in 1859, when he was fifty years old. Perhaps as a result of this prolongation of adolescence, perhaps as a coordinate feature of his extraordinary endowment, Darwin possessed the poetic gift, the gift of creative imagination, in a marked degree. He writes:

> I have steadily endeavoured to keep my mind free so as to give up any hypothesis, however much beloved (*and I can not resist forming one on every subject*), as soon as facts are shown to be opposed to it. . . . On the other hand, *I am not very sceptical*—a frame of mind which I believe to be injurious to the progress of science.

Here is the poetic temper showing, quite unconsciously to its possessor, through the overlay of scientific training; here we get a glimpse, not of "a kind of machine for grinding general laws out of large collections of facts," but of the credulous and imaginative attitude of the poet.

If I am right in my interpretation, and if Darwin, while never profoundly poetical, still had more than the common share of poetic insight, then we ought to find traces of this character in his books. We must not expect too much, for Darwin pruned his manuscripts to the quick. His son tells us:

> He had a horror of being lengthy, and seems to have been really much annoyed and distressed when he found how the "Variation of Animals and Plants" was growing under his hands. I remember his cordially agreeing with Tristram Shandy's words, "Let no man say, Come, I'll write a duodecimo."

We shall not, then, look for poetic quotations in the "Variation." If Virgil is cited, it will be only in connection with the choice of seed corn; and if Homer is mentioned, it will be only because there is no mention of *Gallus bankiva* either in the "Iliad" or in the "Odyssey." Nor shall we look for poetic excerpts in the "Origin," that wonder of compressed argumentation. But we may fairly turn to the "Naturalist's Voyage," and to the "Expression of the Emotions," and to the "Descent of Man." And if we do, our search will be rewarded.

When, for instance, Darwin is describing in the "Voyage" the feasting of the Indian troops at Bahia Blanca, he not only gives a description which is itself reminiscent of Virgil, but he quotes, in the most natural manner possible, the very words—

> Nam simul expletus dapibus, vinoque sepultus
> Cervicem inflexam posuit, jacuitque per antrum
> Immensus, saniem eructans, ac frusta cruenta
> Per somnum commixta mero—

in which Virgil in the third book of the "Æneid" describes the gorging of Polyphemus. And when he is surveying the desert behind Port Desire, on the Patagonian coast, he says:

> All was stillness and desolation. Yet in passing over these scenes, without one bright object near, an ill-defined but strong sense of pleasure is vividly excited. One asked how many ages the plain had thus lasted, and how many more it was doomed to continue.
>
> None can reply—all seems eternal now.
> The wilderness has a mysterious tongue,
> Which teaches awful doubt.

It is only fair to say that the passage from Virgil occurs in the first draught of the "Voyage," which appeared in 1839 (when Darwin was thirty) as part of Fitz-Roy's work. But then it is also fair to say that the passage from Shelley's "Mont Blanc" occurs for the first time in the edition of 1845.

The "Descent of Man" was published in 1871, when its author was sixty-two. In it he quotes from Tennyson's "Idylls of the King" (1859) the words of Guinevere—

> Not ev'n in inmost thought to think again
> The sins that made the past so pleasant to us—

and, in the second edition (1874), Hookham Frere's rhymed version (1872) of Theognis, Fragment X. The quotation from the Greek poet Xenarchus—"Happy the Cicadas live, since they all have voiceless wives"—bears witness, perhaps, rather to Darwin's sense of humor than to his love of poetry.

The "Expression of the Emotions" came out in 1872, when Darwin was sixty-three. Here he cites from "King Henry VIII." Norfolk's account of Wolsey's "strange commotion," and from "King Henry V." the king's picture of warlike anger. The former passage is correctly given; the latter is printed with some curious omissions, which are not indicated; probably it was written down from memory. The book contains, further, quotations from "King Richard II.," "King Henry IV.," pt. i., "King Henry VI.," pt. ii., the "Merchant of Venice," "King John," "Julius Cæsar," the "Winter's Tale," "Titus Andronicus," "Romeo and Juliet" and "Hamlet." Not a bad list for a man who, four years later, was to declare that he has "tried lately to read Shakespeare, and found it so intolerably dull that it nauseated me!" Here Shakespeare is neither dull nor intolerable, but endowed with "wonderful knowledge of the human mind." And it must be understood that the passages quoted are not taken, haphazard, from a Shakespeare concordance. I have worked through the thirty-seven plays myself, with a view to emotive psychology, and I know what the possibilities of quotation are. Darwin's passages are selected, and I have little doubt that they were remembered first and looked up afterwards. Darwin quotes, again, from Somerville's "Chase" the lines—

> And with a courtly grin, the fawning hound
> Salutes thee cow'ring, his wide op'ning nose
> Upward he curls, and his large sloe-black eyes
> Melt in soft blandishments, and humble joy—

which may pass for poetry. He quotes the "laughter, holding both his sides" from Milton's "L'Allegro"; he quotes twice from Worsley's rhymed version of the "Odyssey"; he refers to the laughter of the gods in the first book of the "Iliad";[1] and he quotes twice from the "Æneid" of Virgil.

I hope that these illustrations of Darwin's use and knowledge of poetry are enough, if not to prove my point, at any rate to give it plausibility. It is, perhaps, not wholly superfluous to add that the absence of certain apt quotations from Darwin's pages is adequately explained by the circumstance that the poets are post-Darwinians. I have found more than once, in discussing this question, that even highly educated persons may be a trifle hazy in their dates.

When, on the other hand, we ask whether Darwin would have retained his poetic sense by weekly readings, the answer must be doubtful. If he had read with any overt intention of refreshing the intel-

[1] So I have always interpreted the rather puzzling passage at the beginning of chapter VIII. My colleague, Dr. L. L. Forman, suggests, however, that Darwin may have confused the Greek with the Norse gods. If this is the case, the reference is probably to some prose work upon Norse mythology.

lect or building up the moral character, then very certainly the effort would have ended in failure; poetry must be taken for its own sake, or it may as well not be taken at all. I incline to the opinion that the readings, while they would undoubtedly have increased the store of possible quotation, would still have left Darwin with the regrets that the "Autobiography" expresses.

The argument of the present note may now be summarized as follows. I do not think that Darwin ever had a profound interest in poetry; the scientific temperament was too strong in him. The historical plays in which as a schoolboy he took "intense delight" probably interested him in the main as stories. The poets whom he read during his plastic period probably attracted him, in large measure, by their felicity of language; the cult of words and phrases is characteristic of adolescence, and is curiously different from a real appreciation of style—into which it may or may not develop, according to the temperament of the reader. On the other side, I think that Darwin's poetic leanings were much more pronounced and much more persistent than those of the average man of science. By his own unconscious confession, and by the evidence of his written works, his mind was leavened with poetic feeling; all through his mature life he is ready with quotation when the occasion calls; and the very poignancy of his regret for the loss of poetry witnesses to his poetic endowment. If and in so far as he did lose his poetic interests, the loss was due, not specifically to his occupation with science, but generally to the combination of a stupendous life-work with continued ill-health. "For nearly forty years he never knew one day of the health of ordinary men," and in those forty years he revolutionized biology. Small wonder, then, that he had neither time nor energy for that critical cultivation of poetry which, however gifted the temperament, is the *sine qua non* of a true poetic insight. It was not that addiction to science brought with it an atrophy of the higher esthetic tastes. It was rather the fact that an esthetic power, distinctly above the average, though not of the first rank, was left, by the demands of an absorbing pursuit upon a frail constitution, to work itself out unguided, and to show itself as best it might. The cry that Shakespeare is intolerable is the cry of a man to whom Shakespeare is familiar from cover to cover, tragedy and history and comedy, and for whom Shakespeare might, under other circumstances, have been a source of never-ending delight.

I have spoken only of poetry. The considerations which I have here urged apply, however, with the necessary modifications, to Darwin's loss of pleasure in pictures and music.

A BIOGRAPHICAL HISTORY OF BOTANY AT ST. LOUIS, MISSOURI. II.

By Dr. PERLEY SPAULDING

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THOMAS DRUMMOND[9] was born about 1780. He is known to have been a native of Scotland, but the exact place of his birth is unknown, as is also his early training and education. He was a brother of James Drummond, the Australian botanical explorer, and is known to have succeeded George Don in the nursery at Forfar. In 1825–6–7 he accompanied the Second Overland Arctic Expedition, led by Sir John Franklin, as assistant to Dr. Richardson, who was the naturalist of the expedition. In Canada Drummond explored very extensively, even into the Rocky Mountains and on the Mackenzie River where the main part of the expedition did most of its work. Upon the completion of the journey he returned to England, and from 1828 to 1829 he was curator of the Belfast Botanical Garden. Soon after his return to England he published a work upon the American mosses, which was chiefly the result of his collections made in Canada. He again sailed for New York under the patronage of Drs. Hooker and Graham, for the purpose of exploring the southern and western United States. Beginning his tour at New York City in the spring of 1831, he went to Philadelphia, visited Bartram's garden, thence to Baltimore, Washington, and to Wheeling on foot. At the last-named place he embarked for St. Louis, descending the Ohio River and coming up the Mississippi by boat. It was his original intention to join some fur-trading expedition to the far western country, but he arrived in St. Louis too late for this. He accordingly remained in St. Louis and collected in the vicinity until the next winter. He lost considerable time by sickness, but in January he sent a collection of several hundred species of phanerogams and a considerable collection of mosses and hepatics to Hooker at Kew. Hooker

[9] Date of birth and photograph supplied by Mr. J. R. Drummond, grandson of Thomas.

Hooker, Wm. J., *Companion to the Jour. of Bot.*, 1: 21–26, 39–49, 95–101, 170–177, 1835; 2: 60–64, 1836. *Journal of Botany*, 1: 50–60, 183–202, 1834. *Botanical Miscellany*, 1: 178, 1849.

Lasègue, A., "Musée Bot. de M. Benj. Delessert," 196–198, 1845.

Sargent, C. S., "Silva of North America," 2: 25, 1891.

FIG. 3. THOMAS DRUMMOND.[9a]

From a crayon portrait at the Kew Gardens; by permission of the Kew Garden authorities, through the kindness of Mr. J. R. Drummond, grandson of Thomas.

seems to have prepared his collections for distribution, and we find him publishing a list of about two hundred and fifty species which were collected around St. Louis by Drummond.

During the next spring and summer Drummond collected in the vicinity of New Orleans, and here he obtained even more plants than he did at St. Louis. He next went to Texas, which he was one of the first to explore botanically. Here he gathered a rich harvest, in spite of a season of the most unfavorable weather. He then returned to New Orleans and went to Appalachicola in 1835 for the purpose of exploring the Florida peninsula. He soon left western Florida with the intention of reaching Key West by way of Havana, Cuba. Hooker learned that Drummond was taken sick while at Havana and died very suddenly in March, 1835.

Harvey dedicated the genus *Drummondita* to the two brothers.

[9a] By an unfortunate error, this portrait of Thomas Drummond was in the last issue of the MONTHLY printed as a portrait of William Baldwin, and the portrait of William Baldwin was printed as the portrait of Meriwether Lewis.

FIG. 4. PRINCE MAXIMILIAN: from his "Reise nach Brasilien."

Very appropriately *Drummondia,* a genus of American mosses, was named in Thomas's memory by his patron, Sir William Jackson Hooker. Numerous species of our phanerogams are also named after this most industrious and successful collector.

Even persons of royal lineage were numbered among the many naturalists who came to America for the purpose of exploring unknown sections for new plants and animals, and to make scientific observations. While Prince Alexander von Humboldt attained eminence for his travels and scientific worth, he was not the only royal person who did so, although we generally hear no other mentioned. Alexander Philip Maximilian, Prince of Wied neu-Wied, came to the New World on two different occasions. On the first tour he visited Brazil, and on the second he visited the United States and especially the northwestern or Missouri country.

Prince Maximilian[10] was born on September 23, 1782, in Wied

[10] Thwaites, R. G., "Early Western Travels," Vols. 22, 23 and 24.
Maximilian, Prince, "Reise nach Brasilien," 1820–1.
Sargent, C. S., "Silva of North America," 9: 138, 1896.

neu-Wied, a small principality of Rhenish Prussia. He was from boyhood of a studious inclination, and early became interested in the natural sciences. In spite of this he was in the Prussian army at the battle of Jena, and was among those captured by the enemy. He returned to his studies at the end of this war, but was among the victorious army which entered Paris in 1813. In this service he earned the iron cross of Chalons and a major-generalship. During all of this time he had been planning a scientific expedition to Brazil in order to satisfy a keen desire to add to the world's knowledge, imparted to him by the celebrated Professor Johann Friederich Blumenbach, of whom he was a favorite pupil. Early in 1815 he started for Brazil. He was joined in South America by two other German scholars, and the trio spent two years studying the flora, fauna and native races of this country. His resulting publications gave him a high rank among the scientists of the period, and his " Reise nach Brasilien in den Jahren 1815 bis 1817 " was soon translated into the French, English and Dutch languages.

In 1832 Prince Maximilian started on a second enterprise—a trip to the trans-Mississippi region. He arrived in Boston on the fourth of July. He brought with him a very capable artist, for the express purpose of obtaining portraits of famous Indians. He made more or less brief visits to Boston, New York and Philadelphia, and then went to Bethlehem, Pennsylvania, and thence through the coal region, reaching Pittsburg in the autumn. The journey was then continued overland to Wheeling, where they embarked for the voyage down the Ohio River. They turned aside for the purpose of visiting New Harmony, Indiana, where then was located the best library of American and natural history west of the Atlantic seaboard. Here the winter was spent studying and preparing for the journey on the Missouri River. On March 16, 1833, the journey was resumed and they arrived in St. Louis before the fur-trading expeditions had left on their annual trip to the northwest. Following the advice of several St. Louis men, the journey was made by boat up the Missouri River, instead of by land, as was at first planned. On April 10 the journey was commenced, and by the twenty-second they had reached Fort Leavenworth. The expedition was continued to Fort McKenzie, on a branch of the Yellowstone River, among the Blackfeet Indians, where they remained for two months. The return trip was begun on September 14, and the succeeding winter was spent at Fort Clark, near the present town of Bismarck, North Dakota. The next spring Prince Maximilian returned to St Louis and journeyed eastward by way of the Ohio canal and Lake Erie to New York, where he embarked for the Old World on July 16, 1834. Upon returning from the upper Missouri country the collections which had been made were left behind to be sent down the river in another steamer which was soon to follow the one carrying the party. A fire broke out on this steamer and

many of the collections were destroyed because they were not deemed of as much value as other things which were on board.

After his return to his native city Prince Maximilian worked over his collections and other material with the aid of a number of experts, and published several papers upon his results. In 1843 he published his "Systematic View of Plants Collected on a Tour on the Missouri River." His collections are preserved in the museum of his native city, where he died in 1867.

Martius honored him by naming a genus of Brazilian and West Indian palms, *Maximiliana,* thus very appropriately connecting him with the botany of that country, of which he was one of the pioneer explorers.

Hardly had Prince Maximilian started for home before another explorer was at work on the Missouri. This person was none other than Thomas Nuttall, the greatest botanist of this country in his time. As has been already mentioned, he had visited this section in company with John Bradbury in 1811.

Thomas Nuttall[11] was born in the town of Settle, England, in the year 1786. His parents were in very moderate circumstances, and the boy was early apprenticed to a printer. After several years he had a disagreement with his employer and went to London seeking for work. Here he came very near total destitution. When about twenty-two years of age he emigrated to America, landing in Philadelphia. During his youth he so improved his spare moments that he acquired an intimate knowledge of the Latin and Greek languages, and he seems to have studied other branches, as he was described at the time of his landing as "a well-informed young man, knowing the history of his country, and somewhat familiar with some branches of natural history, and even with Latin and Greek." Nuttall knew nothing of botany at this time, but very soon after he became interested in the "amiable science," and also began an acquaintance with Dr. Benjamin Smith Barton. His studies of plants naturally led him into making short excursions which soon lengthened as his interest deepened, until he had visited the lower part of the Delaware peninsula and the coast region of Virginia and North Carolina.

At about this time Nuttall became acquainted with John Bradbury, and he eagerly proposed to accompany him on his trip up the Missouri River. Accordingly,Nuttall joined Bradbury at St. Louis, and early

[11] Short, C. W., *Transylvania Jour. of Med.*, etc., 34: 14–16, 1836.
Meehan, Thos., *Gardeners' Monthly*, 2: 21–23, 1863.
Durand, Elias, *Proc. Amer. Phil. Soc.*, 7: 297–315, 1860.
Sargent, C. S., "Silva of North America," 2: 34, 1891.
Britten, Jas., and Boulger, G. S., "Biographical Index of British and Irish Botanists," 129, 1893.
Anonymous, POP. SCI. MONTHLY, 46: 689–696, 1895.
Harshberger, J. W., "Botanists of Philadelphia," 151–159, 1899.

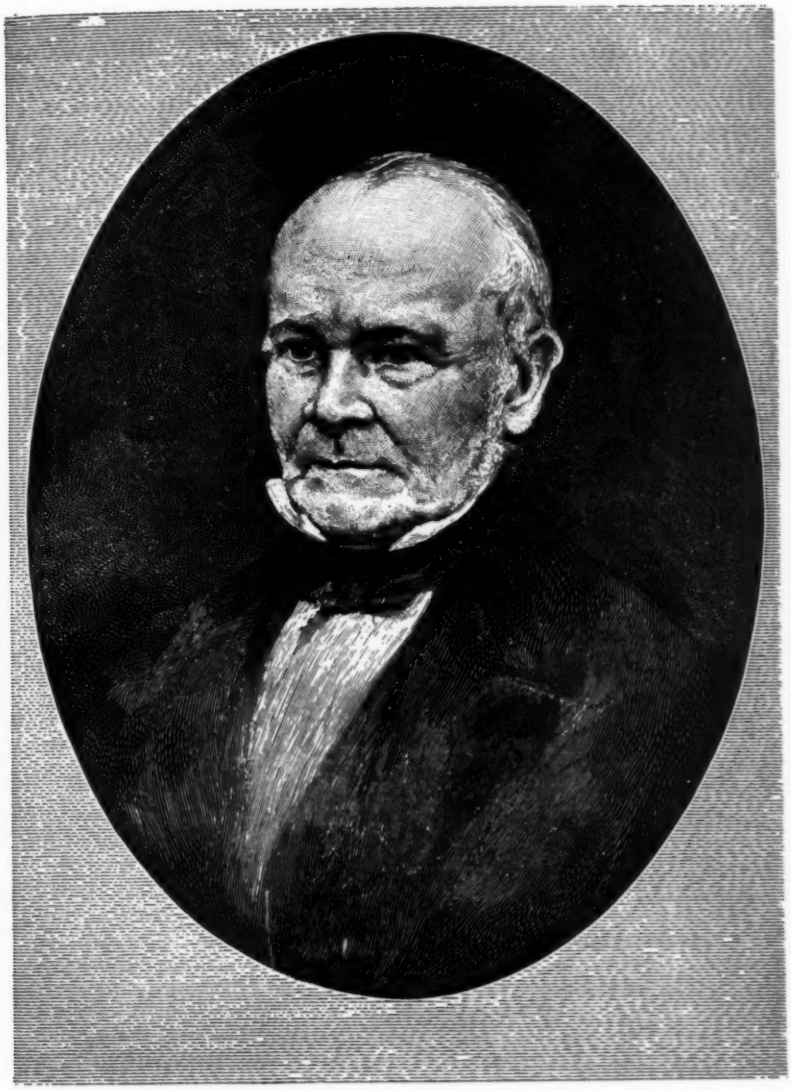

FIG. 5. THOMAS NUTTALL; from THE POPULAR SCIENCE MONTHLY, Vol. 46, 1895.

in the spring of 1811 the two made the journey up the river to the Mandan villages, as previously described in this paper. Both naturalists were more than once in extreme danger, but Nuttall brought back with him many treasures of seeds, plants and other objects of interest. The next eight years he remained at Philadelphia, studying in the winter the collections which he made during his summer excursions to various parts of the country east of the Mississippi, from the Great Lakes to Florida. At about this time he was preparing the manuscript

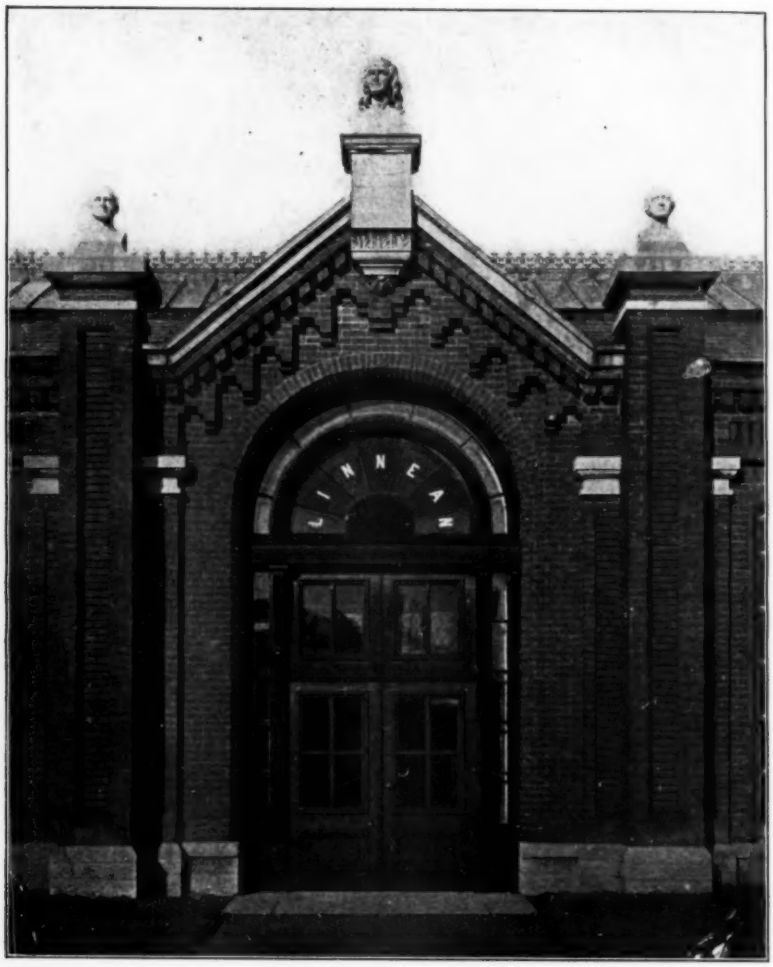

FIG. 6. ENTRANCE OF THE LINNÆAN GREENHOUSE AT THE MISSOURI BOTANICAL GARDEN, ST. LOUIS, MISSOURI; showing the three busts of Linnæus, Gray and Nuttall.

for his "Genera of the North American Plants," which did not appear until 1818. Nuttall himself set most of the type for this work. In 1818 he started from Philadelphia for Arkansas, reaching Fort Bellepoint on April 24, 1819. He made this his center of operations, exploring in various directions and making large collections. He was taken sick with fever and on recovering made one more excursion and then set out for home, reaching New Orleans February 18, 1820. At this time he had made a journey of over five thousand miles through a country still in the undisputed possession of the Indians, and almost wholly unexplored by scientific men. Immediately upon his return to Philadelphia in 1820 he began to study his collections and to write his

FIG. 7. BUST OF THOMAS NUTTALL over the entrance of the Linnæan Greenhouse at the Missouri Botanical Garden, St. Louis, Mo.

"Journal of Travels into the Arkansas Territory During the Year 1819," which was published the following year.

At the end of 1822 he was called to Harvard College as curator of the botanical garden, there not being enough money to support a professorship. He soon became dissatisfied with this and took up the study of ornithology, producing a two-volume manual of this science. About the beginning of 1833 Nuttall went to Philadelphia with the collection of plants made by Captain Wyeth during an overland journey to the Pacific Ocean. A second journey was to be made and Nuttall resigned his position and spent the interval before the departure of the expedition studying the Wyeth collection and his own Arkansas plants.

Mr. Nuttall went in company with John K. Townsend, the two

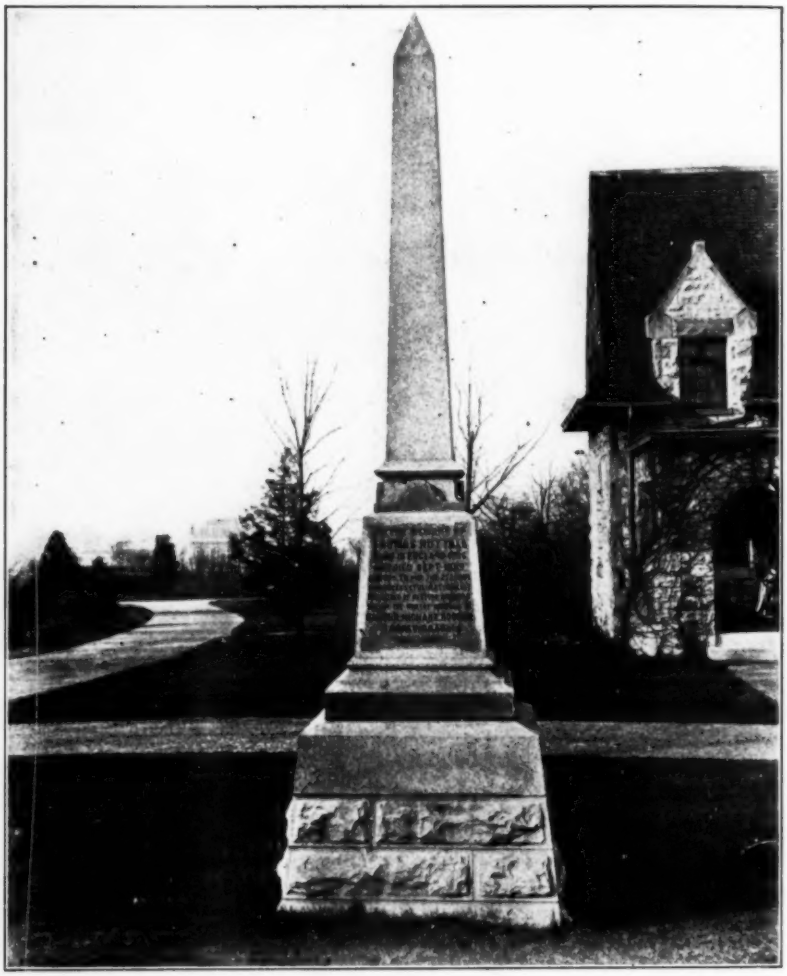

FIG. 8. GRANITE OBELISK IN THE MISSOURI BOTANICAL GARDEN NEAR THE MUSEUM—in honor of Thomas Nuttall.

being sent by the American Philosophical Society. The two arrived at St. Louis on March 24, 1834, on the steamboat *Boston,* from Pittsburg. They started from St. Louis, going on foot to the point of rendezvous at Boonville, Mo., where they joined the Wyeth party. The brief period while they went on foot from St. Louis to Boonville is the one which concerns us at present. Unfortunately the season was so early that Nuttall found but few plants in bloom.

The expedition ascended the Missouri River to the headwaters of the Columbia, and then followed that to its mouth. When winter came on with our travelers on the Pacific coast they took passage for the Sandwich Islands, where they arrived January 5, 1835. Here

Nuttall remained for two months collecting plants and sea shells upon the different islands. He then separated from his companion and sailed for California. He spent most of the spring and summer upon the Pacific coast and then returned to the Sandwich Islands, where he embarked upon the same vessel that Dana was serving his "Two Years Before the Mast," to come home by way of Cape Horn. He arrived at Philadelphia in October, 1835, and settled down to study his treasures. For several years he worked thus and published two important memoirs. At Christmas, 1841, Nuttall went back to England, where he resided the last seventeen years of his life. This was not from choice, but because of the conditions under which an estate was left to him by his uncle, requiring him to live in England nine months of the year. He used his ample grounds for growing rare plants. Just previously to leaving the United States he wrote a supplement to Michaux's "Sylva." In the preface his wanderings were outlined. He returned to America but once, when he took the last three months of 1847 and the first three months of 1848. At this time he studied the plants brought by Gamble from the Rocky Mountains and Upper California, and published a paper upon them. His death occurred on September 10, 1859, resulting from overstraining himself in opening a box of plants.

Torrey and Gray dedicated a genus of the Rosaceæ *Nuttallia,* to this prince of scientists.

Henry Shaw has honored him by placing a small obelisk of granite near the north end of the museum building in the Missouri Botanical Garden, with the following inscriptions: on the north side, "In Honour of American Science," and on the south side, "To the Memory of Thomas Nuttall, born in England 1786 and died September, 1859. Honour to him the zealous and successful naturalist, the father of western American botany, the worthy compeer of Barton, Michaux, Hooker, Torrey, Gray and Engelmann." He also placed over the entrance of the main greenhouse in the Garden three busts: that of Linnæus in the middle, and those of Nuttall and Gray on either side.

Although Nuttall explored the Missouri country on two different occasions and worked in Arkansas, he seems never to have published any considerable list of plants found by himself near St. Louis.

(To be continued)

THE ART OF BLEACHING AND DYEING AS APPLIED TO FOOD

By Professor E. H. S. BAILEY
UNIVERSITY OF KANSAS

AT last the time seems to have come when the public will have to choose between those food products which from their beauty of coloring or their superior whiteness appeal to the eye, although they may be of doubtful wholesomeness, and those foods which are in their natural state, and have not been "processed" to make them appear better or more desirable than they really are.

That we are becoming rapidly educated in matters that pertain to pure food there is no doubt, therefore those who are nearest the sources of information and who have the opportunity to study the action of foods upon the system may direct public opinion in the right channels. Thinking people always "want to know," even if they are not always quick to overcome prejudice and *do* what their judgment indicates is the best.

While we should be the last to attempt to retard the development of taste for the beautiful in coloring as well as in form, it is time to consider seriously what is to be the outcome of "carrying out the color scheme," in the parlance of the society reporter, in the domain of foods whose function is to nourish the human body.

For the past two or three years there has been a protest, in the more progressive journals devoted to hygiene and pure foods, against the bleaching of foods and the addition of color. This coloring has too often been practised to give the food a better appearance, and we regret to say, to simulate an article of better quality. We are now at a point where the people will have an opportunity to show by their support of existing legislation whether they are ready to take advanced ground against bleached and artificially colored foods.

While for hundreds of years bread made from a good quality of wheat was considered good enough, within the past few years a demand has arisen for white bread. If this notion is analyzed it will probably appear that it goes back to the time when a cheaper bread was made from rye flour or from badly milled wheat flour. Perhaps one reason for the dislike for a dark flour was that its use would indicate that the housewife could not afford a higher grade of flour. No doubt the beauty of the white loaf, with its rich brown crust and fine even tex-

ture, also appealed to her. The fact that starch was a comparatively cheap food, and the proteids which made the flour yellow was an expensive food, and that the bread made from the dark flour had a more delicate flavor, was lost sight of in the desire to have a "nice, white" bread to set before her guests.

But the conditions of living have changed, and now most of the bread, especially for the dwellers in the city and village, comes from the bakery. Now it is the baker who tries to fill the demand for a white loaf. With this demand comes naturally enough the effort to get a cheap flour that will make white bread, and the advent of bleached flour into the market.

That this flour is usually bleached by chemicals, just as much as your straw hat is bleached by sulfur fumes, and your sheeting is bleached by "chloride of lime" in the bleachery, is covered up by the statement that the flour is bleached by electricity. Electricity would not injure food, surely! There is no statement, however, that by the use of electricity both nitrous and nitric acid fumes as well as oxides of nitrogen are developed, and that they have, as Professor T. H. Shepard has recently shown, a powerful antiseptic action and actually retard digestion for a longer or shorter time, dependent on the strength, the action of ferments existing in saliva, in the gastric and in the pancreatic fluids. If this is true how can the product do otherwise than retard digestion?

Another phase of the bleached flour question is that this process is used to enable the miller to put on the market a larger per cent. of white flour than he otherwise could, and, of course, greatly to his advantage. This bleached flour is then plainly misbranded unless it bears the label "artificially bleached." Then the customer can purchase this chemically treated flour if he thinks best.

While discussing the use of a bleachery in the preparation of foods, what about the use of sulfur fumes in drying fruits, on the large scale? Is it not possible, the careful housewife inquires, by using a little more care and better stock to dry these fruits without the use of sulfur, or at least with the use of an extremely small quantity? It is true that the dried product may by its color suggest the article that our grandmother used to prepare on the farm. After all, was that so very objectionable, and was the flavor of a dried apple pie made from fruit that had not been bleached and processed until all flavor was gone, so very disagreeable that we did not ask for another piece?

Since the people possibly had the idea that white asparagus was better than green, and that a light-colored sweet corn was more agreeable to the customer than that having the slightly yellow color which nature had given it, the manufacturers began to bleach these products with sulfites in the process of canning. This was in deference to a

supposed demand, but the fact that the sulfites might injure the flavor and lower the value of the food from a dietetic standpoint, was entirely lost sight of by the packers.

That much of the food still on the market has been badly spoiled by the art of the colorist, as well as at the bleachery, goes without saying. It is necessary to mention only a few of the foods that have been mistreated in this way. Maraschino cherries are sometimes first bleached and then dyed with coal-tar colors, like a piece of dress goods, any color to suit the prevailing style. Tomato catsup has to bear the burden of sometimes containing much of the refuse, peelings and inferior fruit of the cannery, preserved, it is true, by benzoate of soda, but brought up to the brilliant color desired, by the liberal use of aniline colors. We find it hard to resist the suggestion that in some of these products color is added to conceal inferiority. The best tomato catsup, however, is not made after the receipt mentioned above.

Within the last two or three years artificial color has not been as abundantly used in jams and jellies as formerly, thanks to the provision in the laws of most states, that the constituents of the product must be plainly stated on the label, or the goods would be condemned as misbranded.

Now-a-days you can actually buy ground mustard of good quality that has not been colored yellow with turmeric to cover the inferiority of an article of low grade. Since lemons happen to be yellow, the manufacturers of the extract have thought it allowable to make a weak alcoholic solution of the oil of lemon and color it yellow with a coal-tar dye so that it might appeal to the eye of the purchaser, who, of course, does not investigate by removing the cork and tasting the material. It was a serious fraud upon the consumer. Fortunately, however, at the present time, the people are becoming educated so that there is a demand for an almost colorless extract of lemon, of standard strength. They were no doubt surprised to learn that it did not have to be yellow to be good.

Not long ago the author had occasion to examine a can of French peas (petits pois). They were of a brilliant green color and evidently colored by the use of sulfate of copper. A very tasty brass label was soldered on to one side of the can. When this was removed, however, there appeared in English the statement, "colored with sulfate of copper." Thus the deception practised had been concealed from the consumer.

Bleaching, as carried on by the use of moisture and sunlight, upon the household linen, was apparently a natural process, at least it did not injure the goods. By growing plants away from the sunlight, and thus retarding the growth of the chlorophyl cells, it is possible to bleach the stems and other parts. The natural color of fruit is developed by

growth in air and sunshine. We are content with the ruddy glow of the apple, the blush of the peach and the rich scarlet of the strawberry, and ask no artificial coloring to improve them. When these fruits are preserved, or extracts or juices are put upon the market, are we not entitled to the natural product without falsification or adornment? If in the process of preserving the color is not wholly retained, let it go; the flavor of the fruit will not suffer from loss of color, and we soon learn that this change of color goes with fruit preserved in that particular way. The manufacturer prepares only what he believes is demanded by the people, so, after all, the consumers must indicate whether they want artificially colored food or not.

In regard to the artificial coloring of ice-cream, jams, jellies, preserves, gelatin preparations, canned fruits, vegetables, extracts and all foods that have heretofore been colored, the safest position is to demand that they appear on the market without the so-called "improvement," by the art of the color manufacturer, no matter how skillful he be. In this way only are we assured of the quality of the article and its freedom, from this source, at least, from injurious ingredients.

MR. ROOSEVELT'S OPPORTUNITY AS PRESIDENT OF A UNIVERSITY

By Professor DICKINSON S. MILLER
COLUMBIA UNIVERSITY

As one grows older one grows weary of mere generality and abstraction. It would be easy to expatiate at large in this article on the ideal of American universities and the best work that could next be done for them. That, or some of the elements of that, are my subject. But one may well reach out, in this thin medium of idealism, and catch at anything that has more body and more instant meaning. The name of Mr. Roosevelt has come into mention in connection with the leadership of four American universities. There is no evidence whatever, so far as I am aware, that Mr. Roosevelt himself would seriously entertain such a project; and definite announcement has been made of plans that appear to conflict with it. But there is time in store, and universities not a few. In any case it happens that this particular public character serves as no other illustration could to give point to certain suggestions about university life. The human illustration is too helpful to forego.

These suggestions relate, first of all, to the nucleus of the American university, the "college." As compared with all other departments, this part of the institution is in a plight all its own. It suffers from a comparative lack of motive. We have most of us remarked the difference in a student's work when he passes from the college to a professional school. When that step is taken, and the need of a living, the chance of gain and success come home to his daily work, the change in many cases stirs for almost the first time a youth's profound intellectual repose. Machiavelli is right in observing that fear is commonly a more powerful motive than love. At all events the fear of poverty is more powerful than the love of "general culture." To make the balance even, the motives of interest and attraction on the latter side need to be discerningly reinforced. The problem is psychological. Can it be said that in the circumstances of undergraduate study at present there is much to invest the things of the intellect with glow and fascination for average minds? Any one who has talked with students about their election of studies notices that after some experience they will often choose not from the comparative interest of the

subject but from the comparative interest of the teacher. Admiration and imitation are amongst the most potent of all formative forces. A young man, whether he knows it or not, wants a hero. This want may of course be supplied for him in very varying degrees and equivocal manners. But at all events he has an eye for such diverse points in his companions as physical prowess, genial manner, wit, leadership, distinction of air, some of the best parts of character, wealth or money-making power—not to mention the grand item of elegant and gentlemanly attire. Now a professor, to the undergraduate, is a more or less amiable "grind" of riper years. Riper, but still unluscious. He is in the center of the undergraduate's vision for an hour, let us say, three times a week; mainly under that lecture-system which, as it has been with fine accuracy stated, enables the student to lean back and observe at perfect leisure the personal peculiarities of the instructor. The student is to have a career in time himself, and dimly or consciously he looks forward to it. A general, a statesman, an explorer, an orator, a sportsman, a successful lawyer, an archmillionaire—or even an artist—is by no means without interest for him; but the amount of *Lebensherrlichkeit* represented in a professor does not reach what psychologists call the threshold of his appreciation. This fact colors the feeling of his class. To teach young men like themselves might appear a high calling were it not that to bore young men like themselves seems a dingy trade.

Now it must candidly be confessed that the student's view is not without some elements of justice. A profession whose chief function is performed in the classroom and which yet so often leaves the classroom-hour on the whole such a lackluster memory does forfeit its claims to some portion of the glamour that might perhaps ideally attach to it. Not that the memory should be simply of entertainment. There is much in the saying of Epictetus that the lecture-room should often be, like a surgery, rather a place of beneficent pain than of pleasure. What is important is that it should be a scene of effectiveness.

In 1881 Phillips Brooks, then preaching at the full tide of his influence, was invited to become chaplain and professor at Harvard. Efforts were made by men of weight in Boston to induce him not to quit his work in that city. Mr. John Long, then governor, wrote in the course of a letter since published:

> The Harvard boys do not need you so much. They have everything already. If they develop some wild oats, yet the general surroundings of their college life lead them to higher opportunities and standards sooner or later.

Mr. Henry Higginson wrote:

> You can't work on those boys in the same way, simply because they are at the questioning, critical, restless age. The worst of them are not bad, but frivolous or idle-minded. The best of them are seeking for the truth everywhere,

and had better seek by themselves. Let them ferment. Of course you can help many a restless spirit, when he *wishes* to be helped—but you can do it as well here as at Cambridge.

Mr. Robert Treat Paine wrote:

College life is full of fun and froth and frolic and frivolity and scurrility. It is acutely critical. It turns into sport everything, sacred and profane. Life is free there first—full of joy and sparkle, full of study and sports, absorbed and preoccupied. Entire absence of variety in experience; death, marriage, children, business, failure, sickness, suffering, danger, all that makes adult life so full—none of all this enters the life of the student. . . . Surely this is the least impressible part of life. It is not responsive, it has no magnetism in it.[1]

That the best youth seeking truth in a university "had better seek by themselves" and that youth (at least if at college) "is the least impressible part of life" are doctrines of precisely the tendency that occasions the present article.

It would be grossly unfair to take these remarks, dropped as they were in the course of a heartfelt argument for the surpassing value of Phillips Brooks's work in Boston, as though they stood for the whole thought or final attitude, on the subject, of the writers' minds. And no doubt Brooks solved his personal problem with a wise caution in refusing to leave his own rich field for one untried. What the letters completely miss, however, is the fact that the extraordinary conjunction in college youth of the freshly acquired faculties of manhood with freedom from manhood's burdens and chilling memories is not a mere hindrance to the great leader but an extraordinary opportunity. Appreciation of certain things has not come in youth because experience of them in oneself has not come; but the liberated energies are ready for ardor and enterprise and generous impulse as those of the burdened and hard-worked can never be. Have we not heard of something called youthful enthusiasm and of something called youthful idealism? A writer of genius has described youth as "cold and pitiless." That is, though it *sees* (with what sharpness!), its sympathies fail much, because it has not felt for itself such things as are behind the face it sees. That is the sole reason, for the youth *plus* the experience (might it be remembered?) is the material of which the less "pitiless" man is made. No one can long observe the studentry of a college, watching them in their sports and crises, without seeing a fire ready to be kindled, waiting only for the spark. If college youth are cold on their more serious side it has at least something to do with the fact that so many of the minds with which they come in contact are absolute non-conductors of heat.

It will perhaps be clear at this point why I can not forego the human

[1] Allen, "Life of Phillips Brooks," Vol. II., ch. 10.

illustration of my meaning furnished by Mr. Roosevelt. I remember a lady of exquisite perception saying that for twenty years and more she had lived near a great university and that she looked to see there in the future "a blaze of impulse." Has there been any one in our history who could kindle "a blaze of impulse" in a community of young men as Mr. Roosevelt could? As a psychologist has remarked, he is a born moralist. And the moral principles he preaches (the fact is often made a reproach to him) are not above the comprehension of everybody; they are what were called long ago "the great commonplaces of morality." He may regard the disdain of fastidious minds on this account with much equanimity. Life is indeed "a rediscovery of copy-book maxims." The somewhat slender hold that born moralists for the most part have upon the young man is due to their not being rich in natural life and in the raw material of human nature. There is just a touch of the astringent about them; a taste of "moralic acid." In other words they are not quite the type that he spontaneously admires. The combination in Mr. Roosevelt, which for us and in its degree may fairly be called unique, is that of the moralist and the natural hero of average minds. It is something to have in one person the intense preacher and him of whom every boy would say (as the poet said of the "rough-hammered head—great eye, gross jaw and griped lips" of another) "What a man!" At all events the boy would say it if not prompted otherwise by having overheard the acidulous talk of alienated elders. The strong hold of such a leader on his college men would be maintained in part by addressing them. It is something to have a speaker who is also a doer. That he is without grave faults Mr. Roosevelt himself, I cannot help fancying, is the last one who would pretend. That his intention and his nature are not good no unentangled person who has watched him long and closely can easily be found to testify. The general verdict of such is that of Mr. John Morley: "A man and a good man." We have had hasty and crude statements from him on subjects where he was not at home; we have in general ceased to have them when be became at home on those subjects. We have had unduly heated language from him under intensely provoking circumstances; a conductor of heat has the defect of his quality. We have had plentiful charges against him of inaccuracy and worse. The statistics respecting charges of loose statement against responsible executives, if they could be gathered, would be interesting and to many surprising. Decision in each case is possible to no man without searching investigation. The statistics in regard to actual accuracy in general would perhaps in each case surprise none so much as the one they concerned. I would not condone looseness in such matters; much to the contrary; but I would remind

the accusers of themselves and of cautious justice. Whether his statecraft has on the whole been correct is a political question, out of place here. No doubt there are those who would try to punish him for deviations from the public policy they have desired by opposing him for a non-political post. With such animosity I shall not contend. We know that in the vast range of remote appointments Mr. Roosevelt's selection of men for places not the highest has often been bad. We know that near home, in his cabinet and otherwise, he has surrounded himself with some of the most capable. His desire and his enthusiasm for men of power, his absolute freedom from the jealousy that would surround itself with lesser and merely instrumental men, his generous friendship and laudation, are for our present interest amongst the traits that promise most.

The chief trait, that on which we have already dwelt, is perhaps best characterized in Walter Bagehot's remarks on Mr. Gladstone as a public speaker:

> A man must not only know what to say, he must have a vehement longing to get up and say it. Many persons, rather sceptical persons especially, do not feel this in the least. They see before them an audience—a miscellaneous collection of odd-looking men—but they feel no wish to convince them of anything. "Are not they very well as they are? They believe what they have been brought up to believe." "Confirm every man in *his own* manner of conceiving," said one great sage. "A savage among savages is very well," remarked another. You may easily take away one creed and then not be able to implant another. "You may succeed in unfitting men for their own purposes without fitting them for your purposes"—thus thinks the *cui bono* sceptic. Another kind of sceptic is distrustful, and speaks thus: "I know *I can't* convince these people; if I could, perhaps I would, but I can't. Only look at them! They have all kinds of crotchets in their heads. There is a wooden-faced man in spectacles. How can you convince a wooden-faced man in spectacles? And see that other man with a narrow forehead and compressed lips—is it any use talking to him? It is of no use; do not hope that mere arguments will impair the prepossessions of nature and the steady convictions of years." Mr. Gladstone would not feel these sceptical arguments. He would get up to speak. He has the *didactic* impulse. He has the "courage of his ideas." He will convince the audience. He knows an argument which will be effective, he has one for one and another for another; he has an enthusiasm which he feels will rouse the apathetic, a demonstration which he thinks must convert the incredulous, an illustration which he hopes will drive his meaning even into the heads of the stolid. At any rate, he will try. He has a *nature*, as Coleridge might have said, towards his audience. He is sure, if they only knew what he knows, they would feel as he feels, and believe as he believes. And by this he conquers. This living faith, this enthusiasm, this confidence, call it as we will, is an extreme power in human affairs. One *croyant*, said the Frenchman, is a greater power than fifty *incrédules*.

This quality is far from the only quality required in an educational leader; but circumstances conspire to give it value in a college. Some-

body is needed to make cultivation seem "worth while." Somebody is needed to "lead the cheering" for study, for work. Somebody is needed to offset the snobbish instructor who says (and whose own sympathies are affected by the opinion): "Debating contests are not a thing that the best class in the university takes any interest in." Somebody is needed to make the prizeman just the least bit of a hero amongst his fellows. Somebody is needed to make the keen intellectual blade or wide reader, whether he take academic rank or not, feel his accomplishment to be something more than an overshadowed and unfashionable brilliancy. Somebody is needed to fan the lurking sparks of ardor in the mind. Somebody is needed to make visible to the young eye that invisible war with powers of the air in which the scholar is a man-at-arms and a campaigner. And if this leader is also an athlete and a sportsman, if this leader of work is also a leader of play, the blend can hardly, as things now stand, be over-prized.

For it brings us, in a rough but ready form, in sight of that round and whole education which is the sane ideal. It might even make the sanguine hope to see in an American university ideas current amongst the healthy studentry as one often sees them in Europe. Such a leader would not stop contented with those excellent athletic contests in which, however, a horde of undergraduates sit as spectators while a few harrassed braves perform. He would be likely to remember that the most successful systems of education, in antiquity for example, cared for the bodily training of every individual. One can not imagine his advent failing to make a difference even to "the unexercised and the unwashed."

But the difference made by his advent as regards moral ideal is the least to be forgotten. I will not repeat what is so often truly said about the state of the moral atmosphere in the nation with regard to money. Which are the personalities that really glitter to average young eyes? When a brilliant man of business and of fashion accumulates a vast fortune in his last years by methods believed to be dishonorable and dazzles a city by his social charm, the tasteful splendor of his surroundings, and his business power, when it is commonly said in comment on the tales of his private life that "those men do absolutely anything they like," it is noticeable that even the rumors touching the manner of his death do not entirely check the awe of the young listener.

It is something to give collegians an embodiment of what they feel to be dashing success and national power, wholly untainted in point of honesty and private life; something to have brilliancy and probity undivided.

Of course there may be those who feel that Mr. Roosevelt would come whooping into the still air of study and, being used to mightier

affairs, would disarrange nice customs, dishevel sound old proprieties, and step absentmindedly over the college halls. These, however, would be apprehensions hardly worthy of men prepared to stand to their own prerogatives and duties. If Mr. Roosevelt could lend signal aid in education he would hardly dispute that such a task would have its education for himself. And if students delight in his sturdy manhood, it would be a pity that the race of teachers should shudder at his somewhat carnivorous quality and taste for the jungle.

There is, to be sure, a delicacy of tone, a fine and deep cultivation of spirit, a sense of esthetic rectitude in things of detail, that one would gladly see set before "our young barbarians, all at play," in the chief person of their community. The fiery furnace of American public life is hardly the place to foster and finish such a product. Indeed this *fine fleur*—for the truth must be told—does not at present flourish abundantly in American life at all. Our scholarship has largely gone for training to Germany, custodian of the letter rather than of the spirit of culture; and there is something raw in the air at home. But in Mr. Roosevelt's passion for knowledge and for achievement, in the range of a certain information he has in science, history and letters, in the interest and respect he has always shown for the personalities of the men who advance these studies, there is much to contribute toward the first things needful, the foundation of university life.

It is obviously a grave consideration on the other hand that he has had no direct experience, except as a student, of educational affairs. This, however, as it happens, is bound up with the essential qualifications we have been considering. Senator Hoar remarks in his "Autobiography":

> Making all the allowance for the point of view, and that I was then a youth looking at my elders who had become famous, and that I am now looking as an old man at young men, I still think there can be no comparison between the college administrators of fifty years ago and those of to-day. It was then the policy of the college to call into its service great men who had achieved eminent distinction in the world without. It is now its policy to select for its service promising youth, in the hope that they will become great. Perhaps the last method is the best where it succeeds. [And Mr. Hoar notes the distinguished success of President Eliot.] But the effect of failure is most mischievous. Presidents Quincy, Everett, Walker and Sparks administered in succession the office of President during my connection with the Academic Department and the Law School [of Harvard], although Dr. Walker's inauguration was not until later. Each of them in his own way was among the first men of his time. Quincy had been an eminent statesman, a famous orator, and a most successful mayor of Boston. Edward Everett had been in his early youth one of the most famous pulpit orators of the country, afterward a distinguished Member of Congress, Governor of the Commonwealth, Minister to England, and Senator of the United States. He was a consummate orator, on whose lips thousands and thousands of his countrymen had hung entranced.

He was, what is less generally remembered now, perhaps the ablest and most accomplished diplomatist ever in the public service of the United States. Jared Sparks was a profound student of history, somewhat dull as a narrator, but of unerring historic judgment. . . . James Walker was a great preacher and a profound thinker.

We need not venture to pronounce on Mr. Hoar's preference for good old days. What is notable is the suggestion of the effect of bringing successful men of a high type from the midst of the world, for which the student is destined, and putting them in his formative time before his eyes. The result, in honorable ambition, civic enthusiasm and the influence of large ideas upon the tone of mind, weighs something, it must be admitted, against the chosen man's lack of direct acquaintance with an educational institution and with just this species of administrative headship. The appalling diversity of subjects that a national president must master encourages the hope that he would not fail to respond with skill to those of the president of a university.

This brings us to face the question what, at the present juncture, the largest problems of an American university are. I have been forced, however, to dwell at some length on the justness of my human illustration, and on immediate problems that such a leader would help to solve. Space fails me to discuss certain other and more complex problems in which the putting of precisely such a powerful shoulder to the wheel is equally required. With the editor's permission I will return to the subject next month in a second article. These latter difficulties call for a leader who adds to enthusiasm a long-borne burden of the most trying practical experience. They call for one who, if an idealist, has the best reason to be a realist too.

COMMERCIALISM

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THE pessimistic streak, woven into every man's nature, becomes a broad band in the community when industrial interests are prostrate. During the past year, the men who during prosperous times lived in the solitude of their sorrows have come forth and have found appreciative listeners as they denounce our country's sins and despair of its salvation. For a year they have gloated over the frailties of society, the corruption of politics, the degradation of business morals; they have pictured the gloomy future of a country sunk in materialism, a prey to commercialism; they have sung in minor key of the purer days when a man was counted for his worth, when mere wealth carried no weight, when mind was more than matter, when dishonor was unknown.

Every unprejudiced observer sees that affairs are sadly out of joint and he longs for some mighty surgeon to adjust them; but he sees no ray of hope, no cure for human woes in these jeremiads; he recognizes only the old wailing, the old discord, with here and there a new note to catch the ear of passers-by. It is as old as the race itself. Doubtless poor old Adam thought sadly of his bachelor days, untried by any Eve of speculative temperament. The Prisse papyrus, written during the twelfth dynasty and copied from one of the fifth, carries us back to at least 2500 B.C.; its aged author grieved over the degeneracy of his times and longed for those better days of the past. More than fifteen hundred years afterwards the author of Ecclesiastes, pessimist himself, rebuked querulous men who asked why the older days had been better than these; Greek and Roman literature is full of laments and the poets sang wearily of a golden age, long past and past forever. Our own Washington had little hope for his country as he considered the decadence of public and private honor, the selfish anxiety for advancement and the corruption prevailing everywhere toward the close of the eighteenth century. Yet that was our age of gold, when corporations were unknown, when railroads had not been conceived, when petroleum had not soaked the land with its slime and Wall Street had not come to crush the people's energies.

Commercialism is the superabounding cause of all troubles; a vague

something is this term commercialism, eluding definition, but evidently including all that is evil. It is the spirit of business. To denounce commercialism is the duty of every "high thinker"; the defender of business men can rarely obtain fair hearing. If in modest position, he is liable to be treated with mingled pity and contempt; if in responsible position, he is likely to learn that he is biased by self-interest; if a college officer, he is cast out of court at once as a hireling, because at some time or other a business man has done something for the college. The "high thinkers" can be described only by Job's reply to his similarly self-sufficient and equally ill-informed friends—"No doubt but ye are the people and wisdom shall die with you."

These critics of our day in their denunciation of commercialism are merely plagiarists of not very high order. The ancient Persians avoided commerce as a baneful pursuit, fatal to integrity; the Roman held commerce in slight esteem and mocked the gold-worshipping Athenians with the sneer, *Græcia semper mendax.* Yet those peoples, seeing so clearly the mote in their neighbor's eye, were blind to the beam in their own; while they despised the arts of peace they saw no sin in the arts of war, the wiles of diplomacy or the treachery of conflict. One can understand the Persian's position, but it is difficult to understand how an educated Roman could fail to recognize that his nation's culture had been absorbed from Grecian colonies on the Italian coasts. The Roman contempt for merchants was ingratitude matched only by that of some would-be philosophers of our time. For, be it remembered, civilization and commerce are twin sisters, never antagonistic, but always advancing hand in hand.

The world's greatest debt is due to civilizations born on the Nile and on the Euphrates, six or seven thousand years ago, both of them commercial. The Babylonians, inhabitants of the lower Euphrates area and intermediaries of commerce between India and the Mediterranean peoples, attained to a civilization prior to 2500 B.C. apparently comparable to that of Great Britain in the eighteenth century. It was marked by studies in science, by literature, by a noteworthy system of laws and by prosperity of the common people as well as of the rich. It dominated the whole of southwestern Asia and by 1500 B.C. its language had become that of the court even in Egypt and Asia Minor. When the course of commerce was diverted to the Red Sea and Alexandria, the glory of the Euphrates departed, to return only for a little when commerce revived under the caliphs of Bagdad.

Close intercommunication and the interchange of products along fifteen hundred miles of the Nile, conjoined with a vast caravan and sea trade with Arabia, Asia Minor and Mesopotamia, as intermediaries of the whole region drained by the upper Niles, led to the development in Egypt of a civilization whose remains are even more notable than

those along the Euphrates. Its character appears from the architecture, the engineering works, the agricultural operations as much as from the literature and the science. When one views the ruins at Karnak and considers that the rock on which the Egyptian sculptor labored is one of the most intractable granites known, he marvels at the sculptors' skill as much as he admires the genius of the architects who planned the gigantic structures. If instead of granite from Syene the material had been soft Pentelican marble, the dainties of Grecian architecture and the grandeur of Egyptian might have been united at Karnak.

The Greeks competed long with the Phœnicians for control of Mediterranean trade; their colonies were in Asia Minor, Italy and Sicily as those of the Phœnicians were in northern Africa and the west. When Psammetichus ended the seclusion of Egypt by opening her ports and by enlisting Greek mercenaries into his army, travelers from Grecian colonies found their way thither, gathered fragments of Egyptian philosophy, literature, science and art and carried them back to their own land to be fused with similar fragments from Arabia, Mesopotamia and Phœnicia, just as seventeen hundred years later the Crusaders brought home with them the knowledge of oriental civilization. The philosophy and literature of Greece originated in her commercial colonies. When Athens and her immediate allies, after the Persian war, wrested commercial supremacy from the Phœnicians, the Piræus was enlarged and Athens became at once the commercial and the intellectual center of the world. Then, the art and thought of other lands unfolded through Grecian genius into wondrous proportions—with a background of no history and a foreground of the dark ages, it seemed to be a veritable Melchisedec, without ancestor, without descendant. Only within the last thirty years has its true place been determined.

Those whose energies are expended in bitter sneers against commerce either forget or ignore the truth that Athens was preeminently commercial. They seem to think that the city was enveloped by an atmosphere of pure intellectuality amid which the necessary merchants moved in a state of semi-asphyxiation. Some years ago, a writer in a religious paper, lamenting modern degeneracy, asserted that in Athens the street boys competed in making verses whereas in New York the street boys play marbles. No doubt some Athenian boys engaged occasionally, just as some New York boys do now, in the possibly lofty game of verse-making, but from what is known of the Athenians and of the Greeks from the earliest times to our own day one may suppose with more probability that the Athenian boys' favorite sport was that of matching small coins. Commerce was never disreputable in Athens; Aristotle is said to have been an apothecary, and Plato an exporter of

oil. That city at the time of her greatest intellectual splendor can be compared in modern times only with cities such as London and New York. Long centuries hence there will be men who too will grieve over decadence of the race and the love of pelf. They will hark back to the days when London, Boston and New York produced such marvelous intellects.

That commerce brings wealth and that wealth brings luxury with eventually moral and physical decadence are propositions which, separately, admit of no dispute; but they must not be united, for wealth, not commerce, is responsible for the luxury and in part for the decadence. Babylon, Tyre, Athens, Corinth and Alexandria were commercial cities; each, after reaching the zenith of prosperity, showed that decay which so delights some students. But the morality of Persia sank to wretched depths in the time of Xerxes, when the vast wealth of many lands had been gathered by conquest; Nineveh, alike commercial and warlike, was enervated by luxury in the time of Assurbanipal and soon sank into obscurity; while commerce-despising Rome, enriched by the spoils of war, became, even before the Christian era, a veritable sink of moral pollution. At the same time one must note the all-important fact that though luxury eventually brings about decadence, still its first fruits among commercial peoples have always been intellectual and esthetic growth. The grandeur of Egypt attained its maxima under luxurious Amenemhat, Thothmes III. and Rameses II.; luxurious, unwarlike Assurbanipal gathered the literature of ancient Babylonia and of Assyria into his vast library at Nineveh; luxury-loving Athens and Corinth, not luxury-hating Sparta, produced the Grecian sculpture and architecture; luxury-loving Bagdad and Cordova encouraged literature and science and, in Spain, built the Alhambra.

Commerce brings wealth; the possession of wealth leads to luxury; a luxurious community is corrupt. This, according to moralists, is the sequence, and the belief in its truth is of such hoary antiquity that to contest it is as though one doubted the law of gravitation. But the belief only proves poor human nature's readiness to shift the blame for its inherent weaknesses. The corruption of a wealthy community differs from that of a savage community not so much in kind as in degree. The clerk who pilfers from a cross-roads shop is in the same class with a bank officer who "appropriates" several millions of dollars. The difference is only in opportunity. Dishonesty in one form or another is so much part of human nature that its spores, so to speak, are breathed out into the atmosphere. A reformer, aggrieved by its constant reappearance, is as unreasonable as the amateur gardener who is perplexed by reappearance of weeds in his carefully tended garden. There will always be enough to give occasion for the philosopher's

tears, enough to give a dull background to any picture; but that is not to say that when one compares this day with that of our fathers he must find reason for renewed sorrow.

Man can not pass at once from savagery to civilization; that change has been in process for millenniums and still it is far from complete. Equally slow is the passage from primeval grossness to ideal purity. The golden rule is a fundamental principle of the ethnic religions as much as of Judaism and Christianity. During more than three thousand years it has been urged as the rule of life, but war and rapine still fill the pages of man's history; yet it has not been ignored and, with the passing centuries, its hold on mankind becomes stronger. In the business world, each period of advance ends abruptly in a storm of stress and panic, by which all seem to be prostrated; but the recession never returns to the previous stage. So in the moral world, the tide flows and ebbs, but each rise advances farther up the slope than did the last—as much in this land as elsewhere.

Three years ago the community was startled by revelations of mismanagement in the great insurance companies and the matter was more than a nine days' wonder. Pulpit and press vied in condemnation of the wicked men. Yet the culprits had not looted their companies; they had not decreased the security of the policy-holders; they had merely utilized their positions for personal gain, making themselves partners with their companies in profitable ventures; they had been guilty of imperfect consecration to the interest of their trust and had shown what wholly unscrupulous men could do. One can well imagine the perplexity of a resurrected magnate of sixty years ago, when told of this crime. Surely he would think that times had changed. In his day such conduct would have passed unrebuked, nay, it might have been commended, as the companies had profited by the transactions. It is rebuked now because there is at last a public conscience which compels respect.

Even politicians recognize this and are not slow to turn it to their own advantage. Only a little while ago, the operations of a syndicate in connection with a western railroad were the subject of governmental investigation; the so-called exposure filled columns of the papers, was made almost a national issue, being utilized in political strife. Yet the whole transaction had occurred in full view of the public without attempt at concealment or deception. The syndicate which owned the property almost outright was charged with increasing the capitalization without equivalent expenditure, but there was no evidence that any one had suffered by the operation, though clearly some one had profited. Whether or not there was any wrong in this transaction is difficult for a layman to discover; but as presented in *ex parte* form, the matter sufficed to justify the astute politician's appeal to the pub-

lic conscience. The existence of the wide-spread sense of justice secures attentive hearing to critics of "commercialism" when they denounce the methods of corporations; *ex parte* statements by prosecuting attorneys and statements by magazine writers are accepted as embodiments of undisputed fact. The development of a public conscience has not been accompanied by equal development of the judicial temperament.

Whether or not the methods employed by some corporations in efforts to overcome competition measure up to the popular conception of the golden rule is not open to discussion. In the original form that rule is "Thou shalt love thy neighbor as thyself"; and it would seem that the obligation is on all alike. But the popular conception is that the command is binding only on the corporations and that all individuals in the community are "neighbors." Yet corporations are merely copartnerships, so that in their case, as in the case of the individual, the standard of the rule is the love of one's self, which brings into consideration the question of self-preservation. A man is justified before the law if he take the life of another to protect his own or that of any under his charge; he may take life to protect his property; equally in business affairs, a man is justified in doing things for self-protection, which under other conditions would be unjustifiable.

The owner of a cross-roads shop, who has built up a good trade by close attention and honest dealing, would be thoroughly justified in bitterly antagonizing a rival who had secured the old stand that he might reap where he did not sow. If, however, success have made him negligent so that he serves his community indifferently, he should not complain against the invasion; he alone is responsible; he had thrown away his estate.

Both conditions are familiar. Corporations find themselves at times as the old, still energetic shopkeeper, fighting to hold his own; at others, as the sturdy newcomer invading an area occupied by sluggish men, satisfied with small business and large percentage profits. To illustrate.

Several men competing in the manufacture of some product combine, reduce working expenses and with the money thus saved secure competent scientific aid for improvement of methods. New processes are discovered, cost of production is decreased, waste is prevented and by-products are utilized; the result being eradication of rule-of-thumb competitors while the innovators gain control of the business to their own great profit and to the great advantage of the consumers. They remain incessant in efforts to better processes and to make new industries; but eventually the earlier patents expire. Other men, in view of this, have been investigating and have discovered improvements in methods, to become available with expiration of the early patents.

The men whose foresight made possible the vast extension now see their property placed in jeopardy by means of their own processes, discovered at great cost, and they struggle to retain their own. Under such circumstances the importance of the golden rule is made very prominent, each side charging the other with neglect; yet, whatever may be the shortcomings of the older manufacturer, one must concede that the newcomer usually regards himself as the neighbor and therefore unfettered.

On the other hand, combinations have invaded areas regarded by others as their preserves; and here is involved the question of a man's natural right to secure a living easily at the expense of his fellows—that which is involved in the department-store problem. A corporation, under heavy fire recently, was charged with the crime of owning its retail shops, while selling its goods to retailers. Yet any self-respecting man would resent an effort to prevent him from selling his own goods according to any one of the approved methods. If a manufacturer, on large or small scale, choose to establish his own retail store or stores, no one has any right to complain—it matters not what the goods may be, cigars, shoes, oil or meats. In any event, such a method would be advantageous to the greater number by leading to division of middlemen's profits between maker and consumer.

The cry in many quarters is for unrestricted competition in trade, but recent events prove the cry to be utter hypocrisy. In one state a suit for ouster was brought against a corporation because, owing to competition, it sold its products more cheaply in some localities than in others. A similar suit was brought in another state because the company had set its prices so low for some years that no competitor could do anything in the region. Evidently the only free competition desired is that which would remain after binding the one on the ground—an open market for the newcomer. The opponent of that company is anxious to have the government enter into conspiracy with him to increase the cost of necessaries of life.

That conditions in commercial circles are not ideal is beyond question—they are far from ideal in any circles and they will never be otherwise until man has passed away and has been succeeded by a superior race of beings. But one must recognize that very much of the wickedness upon which writers descant so vehemently consists merely in so-called evasion of law. It is certain that serious dangers to the commonwealth are inherent to vast combinations of capital; and it is equally certain that imperfect legislation in the past opened the way to abuse, of which selfish men have not been slow to avail themselves. Some form of governmental control is necessary to prevent excess. All recognize that a corporation, being a creature of the law, does not possess natural rights as does an individual; but once

created it has the rights conferred on it and in all legislation those rights must not be forgotten. Unfortunately, most of the legislation against combinations is the offspring of men unfamiliar with the interlacing of business interests, so that while it may correct or destroy one wrong it creates a dozen others. Too often the statutes make criminal that which is ethically just. Such statutes, it is true, are the law of the land and every good citizen should obey them as far as in him lies. But the law requires him to obey the letter, not the spirit, for no created being can fathom the depth of the spirit or divine what was in the mind of those who conceived them. If the laws prove to be ineffective, the fault is not in the citizen, but in the ignorance of the lawmaker. Our country owes a debt of gratitude to those lawyers who, ascertaining the exact letter, have guided our great corporations through the labyrinth of statutes and enabled them to avoid pitfalls. Had not a merciful providence provided those lawyers, the country would have been the loser—and the statute-makers, most of all, should be grateful, for the evils of their work have not recoiled upon their heads. Controlled in most instances by men of great sagacity, combinations have lessened the cost and increased the output of manufactures while bettering the wage-earners' reward.

Assertion that the existence of vast combinations of capital is the surest foundation of national prosperity is, for many, evidence of insanity or of dishonesty or of both. Yet no generalization could be more nearly true. A single illustration suffices.

When the business depression following 1873 ended abruptly in 1879, the iron and steel industry was wholly unprepared for the new conditions. A great part of the furnaces were out of blast and the metal required at once by railroads and other interests could not be supplied. Great combinations were unknown, there were many concerns—there was that unrestricted competition which some regard as Utopian. All had suffered severely during the depression and the few concerns still in operation set themselves at once to make good their losses. A veritable scramble for profits ensued on the part of both employers and employed. The price of pig iron increased so rapidly as to pass the point where the moderate tariff became unimportant and foreign makers unloaded their stocks of metal on us, glutting the market and prostrating the pig-iron industry. Meanwhile the cost of manufactured products had gone beyond what the "traffic could bear" and prosperity came quickly to an end.

The conditions of 1879 were repeated in 1899, but the outcome was wholly different, for the iron and steel interests were concentrated and the business was controlled by a few vast combinations. No one of them could increase the price without consent of all, but any one could hold the price down against opposition by all its rivals. The leading

concerns, mindful perhaps of 1879 and 1880, determined that prices for manufactured products should not exceed a fixed scale, more being ruinous—and they maintained that scale in spite of greatly increased cost of pig metal. The result was almost uninterrupted prosperity until 1907, when the whirlwind of senseless attacks on corporations, as such, swept over the country. Even now the prostration is unlike that following 1873 and 1893. The great organizations, during their prosperity, laid aside a surplus for evil days. When disaster came a year ago, there was no wild rush to dispose of accumulated stocks; there was no crash in prices; there was no wholesale reduction in wages. While there has been want in the distributing centers, the country at large has known no such wide-spread distress as that which followed former business disasters.

But the wisdom of our rulers has made consolidation or combination of competing interests unlawful. A New York judge recently decided that consolidation, even though advantageous to the public, is illegal in case it involve stoppage of competition. If two grocers on opposite corners have waged war until both are threatened with bankruptcy, their friends would advise them to reach an understanding, might advise even union and the closing of one shop, that by reducing expenses and selling at a fair profit they might gain an honest living. Yet there is reason to believe that such a course might be adjudged contrary to law, being a conspiracy to increase cost of necessaries of life. Their customers would certainly express that opinion.

This is no exaggeration. Residents of New York City were well satisfied some years ago to buy coal at $4.50 per ton, wholly indifferent to the fact that the anthracite companies were engaged in reckless and unjustifiable strife. When the contest had gone so far that bankruptcy seemed inevitable for some of the companies, the officers awoke to their responsibility to the helpless stockholders, whose interests they were to guard. An agreement was made to mine no more coal than the market demanded and to charge a price which would enable them to pay fair wages, to meet their obligations and to earn interest on their investments. At once the customers were filled with indignation, the papers denounced the oppressive "coal barons" and agitation began which eventuated in legislation so drastic that, were it sustained by the courts and fully enforced, the companies, deprived of rights guaranteed them half a century ago, would be forced into bankruptcy and millions of persons would be plunged into misery. There is a strong popular feeling that live and let live is the only true policy; but clearly the popular interpretation of this doctrine is wholly one-sided, the policy must favor the consumer alone—in forgetfulness of

the fundamental principle that all interests are mutually dependent, that one can not suffer alone; all must share.

The day of small things has passed; railroads, telegraphs, express steamships have changed the units of competition from individuals to nations. If Great Britain, Germany and the United States are each to have a fair share in the world's markets, they will do so only through the sagacity of men controlling the policies of great combinations. Even in our own country, the territory is so vast that, to secure internal prosperity, such combinations are essential in every department of activity, manufactures, colleges or transportation. Petty rivalries of neighbors are too costly, too wasteful; duplication of plants is folly, when by a slight increase in some portion of one it can be made to do the work of both. In view of this, men should recognize that *vox populi* as expressed in legislative enactments is not necessarily *vox dei;* that right can not be converted into wrong by the vote of an accidental majority; that exact obedience to law is not sin.

FOREIGN ASSOCIATES OF NATIONAL SOCIETIES. II.

By Professor EDWARD C. PICKERING
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A HISTORY of the sciences and of scientific men during the last two centuries, by M. Alphonse de Candolle, was published in 1873. A table is given showing the foreign membership in various societies for the four epochs, 1750, 1789, 1829 and 1869, at intervals of about forty years. Since another interval of forty years has now elapsed, it may be of interest to compare the results with those at the present time. The earlier part of Table I. is taken from M. de Candolle's volume, page 176. The country is given in the first column. Scandinavia includes Sweden, Norway and Denmark. Austria includes Hungary. Russia includes Poland. Spain includes Portugal. A few scattering names are similarly included. The percentages of membership in the various countries are given in the following columns, the year being given in the first line of the headings and the letters designating the various societies being given in the second line. F, B, G and R denote the Institute of France, the Royal Society of London, the Royal Prussian Academy of Sciences and the Imperial Academy of St. Petersburg, respectively. Since only foreign membership is included, dashes are inserted in the case of home societies. Thus, in the first line, dashes are inserted in the column headed G, since no Germans could be foreign members of the Prussian Academy.

Some of the results to be derived from Table I. will be found in

Table I.

Country.	1750			1789			1829			1869				1908			
	F	B	G	F	B	G	F	B	G	F	B	G	R	F	B	G	R
Germany	14	15	—	8	14	—	36	27	—	42	45	—	45	33	39	—	37
France	—	46	43	—	36	33	—	38	41	—	33	38	23	—	18	21	18
Great Britain	17	—	12	15	—	...	29	—	14	29	—	26	16	20	—	17	16
Scandinavia	14	1	7	10	10	3	7	8	12	1	4	9	5	11	9	17	8
Italy	20	14	12	15	16	19	10	8	18	4	2	3	...	7	9	7	8
United States	...	...	...	3	2	3	1	...	...	...	2	3	8	7	11	10	4
Austria	...	...	...	3	...	...	1	2	...	...	...	...	...	3	2	17	5
Holland	6	7	10	10	3	8	3	2	...	...	2	3	...	7	7	7	...
Russia	...	1	2	8	3	6	1	2	8	10	2	6	—	5	2	2	—
Switzerland	17	12	12	13	10	19	7	8	6	9	8	8	5	3	2	...	3
Belgium	...	...	...	3	3	...	3	...	2	4	2	4	1	3	...	2	1
Spain	11	4	2	13	4	8	...	4	...	...	...	...	...	1	...	...	...

Table II. The country is given in the first column, as in Table I. The percentages of the entire membership of each country in the years 1750, 1789, 1829, 1869 and 1908 are given in the next five columns. As the tenths of a per cent. are omitted, the sums are not exactly 100. The seventh column gives the difference found by subtracting the numbers in the second column from those in the sixth. If positive, it indicates an increase, if negative, a decrease in membership during the one hundred and fifty-eight years. These twelve differences may be divided into three groups of four each, including the countries showing a large increase, those remaining nearly the same, and those showing a large decrease. The results are given in the last three lines of the table. It may now be of interest to compare the results of this discussion with that published in THE POPULAR SCIENCE MONTHLY, LXXIII., 372. A list is there given of the eighty-seven persons who were foreign associates of two or more national societies, in 1908. The percentage of these members and of their membership is given in the eighth and ninth columns. They are derived from Table III. of that paper. The tenth column gives the percentage of the eighty-seven members who were born in each country.

TABLE II.

Country.	1750	1789	1829	1869	1908	Diff.	M.	♀ S.	B.
Germany	12	9	24	35	31	+19	34	35	32
France	36	29	30	25	16	—20	14	14	13
Great Britain	12	6	17	19	15	+ 3	15	17	17
Scandinavia	6	6	7	4	10	+ 4	10	8	11
Italy	12	14	9	2	7	— 5	3	4	3
United States	...	2	...	2	7	+ 7	7	8	3
Austria	...	1	1	...	6	+ 6	5	5	3
Holland	6	6	1	1	4	— 2	5	4	6
Russia	1	5	3	4	3	+ 2	3	2	3
Switzerland	11	12	5	6	2	— 9	2	1	5
Belgium	...	2	1	2	1	+ 1	1	1	2
Spain	5	7	1	...	...	— 5	...	...	...
Increasing	18	18	32	41	54	+36	56	56	49
Stationary	19	19	22	26	23	+ 4	24	24	28
Decreasing	64	62	45	33	25	—39	19	19	21

The most remarkable change, shown in Table II., is that of Germany, which passed from the fourth place in 1789 to the first place in 1869, and nearly quadrupled its percentage of membership during that time. The diminution of membership in France is almost equally striking, while the change in Great Britain is slight. The four countries grouped in the last line but two and the corresponding differences are: Germany, + 19; United States, + 7; Austria, + 6; Scandinavia, + 4. The increase in Austria is largely due to recent membership in the Prussian Academy, as shown in Table I., and is perhaps

affected by proximity and a common language. The second group in which the change is small consists of Great Britain, + 3; Russia, + 2; Belgium, + 1; Holland, — 2. The third group, in which the percentage diminishes, contains: Italy, — 5; Spain, — 5; Switzerland, — 9; France, — 20. Evidently this grouping is not accidental, but is due to a common cause. The first and second groups include, in general, central and northern Europe, the Germanic, English and Slavonic races, and the Protestant countries. The third group includes in a marked manner southwestern Europe, the Romanic races and the Roman Catholic countries. The results for the German, English and French groups of countries, represented by the last three lines of the second to the fifth columns of Table II., are shown in the accompanying figure. Horizontal distances represent times and ver-

GERMAN GROUP. ENGLISH GROUP. FRENCH GROUP.

tical distances, percentages of membership. In the first group the percentage of membership has increased about three times, in the last group it has diminished nearly two thirds. The numbers in the eighth and ninth columns, headed M and S, closely correspond to those in the sixth column, headed 1908.

The grouping according to country may be studied in four ways. First, place of birth, to determine the effect of heredity or nationality. Second, education, as indicating the relative efficiency of different colleges or universities. Third, residence, indicating perhaps the best opportunities for work. Fourth, occupation, showing which universities have attracted the greater number of men of eminence. The third form of grouping only was considered in the former paper and is given there in Table III. Three of the European members, represented in Table II., have called my attention to the importance of the first form of grouping. It is not always easy to determine the place of birth, and in a few cases the nationality has been assumed to be the same as that indicated by residence. The most striking case of change is that of the United States. Of the six residents, members of 7, 6, 5, 4, 3 and 3 of the seven national societies, the three members of 7, 6 and 4 societies were born in other countries. The argument in the former paper, that better opportunities for advanced work should be furnished in this country, is thus greatly strengthened. Three of the residents in England were born in Scotland, or as many as in the entire United States. Holland is increased from three to five. The order accord-

ingly becomes: Prussia, 18 members; England and France, 11 each; Holland, 5; Sweden and Switzerland, 4 each; Austria, Denmark, Italy, Norway, Russia, Saxony, Scotland and United States, 3 each.

The fourth method of grouping is easily made. Fifty-five of the eighty-seven members are given in Minerva as officers of one of twenty-six universities. Of these, Berlin has 9 members; Paris, 8; Bonn, Göttingen and Leipzig, 3 each; Cambridge, Christiania, Copenhagen, Erlangen, Harvard, London, Munich and Vienna, 2 each; Amsterdam, Berne, Bologna, Chicago, Heidelberg, Jena, Johns Hopkins, Leiden, Liège, Rome, St. Petersburg, Stockholm and Zurich, 1 each.

THE SCHOOL AND THE FAMILY

By J. McKEEN CATTELL

IN our complicated civilization a change in any direction may have unforeseen effects in other directions. If we do away with an aristocracy of birth, we leave room for a plutocracy and for politics as a trade; if we learn to use machinery, we throw into quasi-slavery a large part of the people; if we improve the means of communication and transportation, we build the tenement districts of the cities; if we develop a system of credits and exchange, we get public debts, panics, lockouts and congested wealth; if we use reason more, the surer instincts atrophy.

One of the cases where notable progress has yielded sinister by-products is the tendency of the school to weaken the family. Civilization may persist and progress without the family; but human and pre-human societies have been so completely based on it that no one can foresee the results of its destruction. Mankind will last only so long as children are born and cared for; and no plausible substitute for the family has been proposed. It is in any case evident that the premature weakening of the family will bring disaster; our reasoned efforts should at present be directed to its support and toward adjusting to it our newer adventures.

The school by its nature weakens the family, for it takes the children away from home and gives them interests not centered in the home. Within certain limits it may be a gain to polish homely wits and supply a new and wider outlook. The family can withstand a certain amount of aggression and may even be the better for it. But the notion is wide-spread that the more years a child spends in school, the more days in the year and the more hours in the day, the better it is, and that the scholastic trivialities inherited from the idle classes are the proper material for education. There is even approval of places like kindergartens and girls boarding schools, which are harmful both to the family and to the individual.

The sacrifice of the family to the school under the best of conditions is serious enough; it is distressing to see methods used that are wantonly destructive. If children are really more cultivated than their parents there is inevitable discord. We can only say that the older generation must suffer for the newer, the present family for the better family that is to be. But the emphasis on superficial book

knowledge that is so common leads the young people to assume a superiority which they may in no wise possess in the more sterling qualities. We greatly overestimate the value of the three r's, the two g's and the one s. People are what they feel and do, much more than what they know; in any case the residuum of knowledge surviving the eight years of the elementary school is pitifully small.

One must learn to read in self defense. If ninety per cent. of the population carry pistols, it will not do for the remaining tenth to go unarmed. And people should learn to read in order to preserve and pass forward the social heritage, which may some time be the endowment of all, and is now the necessary condition for selection of those competent to improve or enjoy this heritage. But the present advantages of reading to the average individual are small, while it is probably injurious to family life. The main benefit of reading for most people seems to be that it is a substitute for alcohol, in which excess does not lead to such harmful consequences. The effect of reading the newspaper or current novel is similar to that from a small dose of alcohol or opium; it relieves conscious strain and the burden of routine individuality. A weekly journal or an ounce of alcohol on Saturday evening would doubtless be better than illiteracy or abstinence; but people will not run themselves as machines subject to the laws of utilitarian hygiene. The Bible may be read aloud and give solidarity to the family and community; the city newspaper absorbs the individual in transient details, not fit to be talked about or remembered. Its tawdriness distracts from homely interests. As a social factor, it is more likely to lead to national hysteria than to solid homogeneity.

There is relatively less to be said against writing and more in its favor. Its acquisition, while likely to be harmful to the immature nervous system, is less destructive than learning to read. What the average man reads is rarely worth while; what he writes is ordinarily of use. As a matter of fact, he writes very little, and could get on fairly well without that little. But of course, under existing conditions, every one should know how to write. I have found that practising on the typewriter for twenty minutes a day for two months, namely, a total expenditure of twenty hours, will enable people to write faster, not to mention legibility, than they could after eight years of schooling and twenty years of practising with the hand, though doubtless it is this practise that makes typewriting easy to learn.

It has become necessary for every one to deal with numbers and quantities, but it is a question as to how far the average man is helped in this by the school work in arithmetic, with the possible extension to geometry and algebra. One of the most persistent errors of our scholastic methods is the teaching of a child of a certain age with great labor and at the production of much stupidity what could be learned

easily and with pleasure a couple of years later. It is possible to teach an infant to walk two months before the body is ready, but bow legs are likely to be the only permanent result. So it may be that the premature use of numbers apart from any real interest is actually harmful. The school work in arithmetic is certainly of very little use.

Exploitation of the conventional spelling and grammar is one of the insignia of the classes, which, like their dress and etiquette, is imitated by the masses without profit. The accuracy of spelling secured by school drill is useless; the syntactical limitations injure expression and style. Nothing much can be said in favor of geography, history and literature as they are taught, or for such science as now and then appears. We have a book method, essential for certain purposes, extended far outside the limits of its usefulness. The clerk or priest becoming teacher regards the elements of those subjects in which he is expert as the only ones proper to education, and the great mass of the people are ready to imitate those who have assumed authority over them. The futile system is supported *ex post facto* by a bad psychology, which claims that the methods used will teach children to observe, remember and reason. Primary education is planned as a preparation for the high school, and the high-school course as a preparation for college; the college is for students preparing for the professions and at the same time a club for the idling classes.

It is not at all clear why the public should pay a thousand dollars for the expenses of each boy who goes through college to enjoy the pleasures of drinking clubs and betting on athletics; and it is surely absurd to let the conventional courses of the college distort every elementary school. As Franklin said, there is a good deal of difference between a good physician and a poor physician, but not much difference between a good physician and no physician; and the same is true of the lawyer, the clergyman, the journalist and even the university president. We could get on tolerably well without all these gentlemen, except only the few who are working to advance knowledge and its applications; and it is, in any case, needless to make their production the principal aim of our educational system. The good ones are born fit for their work, and will do equally well whether they learn to read at twelve or at six.

The imprisoned hope of Pandora is the only justification of our educational system. We look forward to getting some day professional men who will serve a better civilization, and schools that will make children happier, wiser and more useful. In the meanwhile we consume on the altars of our schools more property than the lawyers can guard, more health than the physicians can restore and more unborn souls than the clergymen can save.

The unborn children due to the schools have been too little regarded.

From the very beginning of organic evolution the principal function of every generation has been the production of the next. The origin of each higher species has been an incident of this function, and man who looks before and after has been the final result. The ultimate outcome of evolution has been a rationalism that threatens to end the long process.

Last year the deaths in France exceeded the births by 19,920. In some departments there were less than seventy births to fill the places vacant by one hundred deaths. A patriotic Frenchman has written naïvely that this state of things is not so bad as it seems at first sight, as all civilized nations will soon be in the same condition. It is indeed true that the birth rate is decreasing in every country. The seriousness of the situation is obscured by the fact that the death rate is also decreasing, so that an increase of population has been as a rule maintained. But the decrease in the death rate can not continue indefinitely, and if present tendencies persist the birth rate will fall below the death rate everywhere, as has already happened in France and in New England.

It is now considered praiseworthy to postpone marriage until a family can be supported in comfort, and proper not to have more children than suits the pleasure of the parents. In 81 divorce cases tried in a month in a New York City court—divorces have trebled since 1870—the 162 married persons had among them 52 children. A census of twenty-two apartment houses in New York City proved them to contain 485 families and just 54 children—one child to nine families. These are the extreme cases; but among the educated and well-to-do classes the number of children does not nearly suffice to continue the race. The Harvard graduate has on the average seven tenths of a son, the Vassar graduate one half of a daughter.

These conditions are regarded as bad because the successful stocks are superseded; but to the present writer this does not appear to be the danger. There is probably not so much difference between one stock and another but that in each generation the place of the extinct families can be supplied from the inferior classes to advantage. A hereditary aristocracy is not maintained by inbreeding but by selection from below.

The fundamental danger to society lies in the fact that the pattern set by the ruling classes dominates; and this is especially true in a partial democracy, such as the United States or France. Where classes are distinct and permanent, each can have its own ideals, as it has its own dress. But when the hats and shoes of the rich are imitated by the middle classes, and those of the middle classes by the laboring classes, we may be sure that there will be a similar following of the leader in social customs and morals. If the two-child family

is temporarily standardized for the upper classes, it will soon become the model elsewhere, and when one child takes the place of two, as it is already doing, the contagion will not be limited to the class in which it originates.

It may be that the population of the western world increased during the nineteenth century as rapidly as it could be assimilated. If Malthus had been correct in his theories it might be as anti-social and be made as illegal to have six children as to have two wives. But Malthus was a false prophet; thanks to the applications of science the means of subsistence have increased more rapidly than the population. If the density of population in the United States were equal to that in Great Britain, all the people in the world could live here; and they could live in comfort. There is a complete lack of the constructive imagination which might lead to bitter mourning for the hundreds of millions of human beings that might have been but are not, and to boundless regret for the science and art they might have produced for the benefit of all; but the decline and extinction of the race can not well be dismissed as a matter of no consequence.

It is now only to a limited extent the case that there are vigorous races waiting to take the place of those decayed. The Teutons may supplant the Celts, and be supplanted by the Slavs. If the negroes maintain their fertility and decrease their morbidity, and the eastern nations maintain their family sanctions, they may supplant the white races. But an extension of rationalism and a tolerably uniform world civilization will tend toward similar conditions everywhere in regard to the family and the birth rate. The past history of the human race is probably longer than its future history will be. Physicists tell us that the earth may be uninhabitable in twenty million years; it may be uninhabited by man in twenty centuries.

The disintegration of the family and the decline of the birth rate are due to many causes of which we need here concern ourselves with but two—the city and the school—for the object of this article is to offer a constructive suggestion intended to make these factors less destructive.

The modern city is surely subversive of the home and the family. Houses without individuality, dark and ugly, tenements and apartments, boarding houses and hotels, not owned by those who live in them, inhibit the instinct to form a home. Children do not stay in the house and can be put to no use about it. They are away at school and on the street; later they earn money for themselves. Women are not physiologically fit to bear and nurse children. The father is away all day, and the mother is often away. The parents and the children do not have work, amusements or interests in common. There are no family traditions and sanctions. A certain irresponsibility in the

tenement districts gives a fairly large birth rate and a high infant death rate, but every advance in temperance and thrift decreases the birth rate.

It has been said that we must look to the country for men and to the city for ideas. But the trouble is that the city takes from the country its men and supplies it with ideas and ideals which are unfit. If paternalistic legislation and philanthropic efforts are of any use, they should be directed to the support of the family farm and the country home. A measure such as the protective tariff which builds up the manufacturing center and the city at the cost of the country should be regarded as intolerable. Measures such as agricultural experiment stations, the rural postal delivery and postal express should be welcomed. We need most of all to make life in the country attractive and fine, to lessen routine and incessant labor, to make each church and school a center for the social, intellectual and artistic life of a community.

The country school is at present no such place. Its general tendency is not to prepare children for usefulness and happiness in country life, but rather to make them inefficient and uncomfortable there and to send those who are more clever and ambitious away to the city. And the school shares with the city the bad preeminence of being one of the principal causes now working to break up the family.

It has been noted above that in so far as the school gives children interests not centered in the home, the family is inevitably weakened. This may be necessary in the interests of wider socialization, but in its methods and results the school contrasts unfavorably with the church, especially with the unreformed churches and the Hebrew synagogue. The sacraments of the church—baptism, confirmation, marriage, burial—are closely interwoven with family life; its services, ceremonies, fasts and fêtes are shared together by parents and children. In spite of inconsistencies in creed and in practise, the religious institutions both of the west and east tend by their observances and by their non-rational sanctions strongly to support the family. The school supersedes the church as a socializing factor to the injury of the family. In so far as this result is due to the methods by which the schools are conducted and the kind of instruction given, every effort should be used to find remedies or palliatives. In so far as it is due to the partial rationalization that follows, we are face to face with a difficult problem.

It may be thought that people are not likely to become too reasonable; nevertheless perhaps the principal danger to our civilization is the checking of instincts by rationalistic considerations. The instincts for mating, for forming a home and for the care of the young are prehuman and very strong. But like other instincts, they are only com-

pelling for a limited period and under suitable stimuli. Postponement from prudential motives and the general conditions of modern life lead readily to their atrophy. This occurs first in the dominating and super-educated classes, and the model they set is followed in widening circles. Further it is noteworthy that there is no primitive instinct to have children; the instincts of mating, home-building and the care of the young suffice in the earlier stages; later the chief sanctions have been religious and tribal, and these are waning, largely through the influence of our educational methods. The reinforcement of instincts and impulses by rationally devised sanctions appears to be the only hope there is for the family and so far as can be seen now for the race.

Next after the rationalistic attitude implanted by our present methods of education and the diversion of the interests of children and young people from home life, the most serious injury to the family from the school is probably economic in character. It is said that a boy is legally of age at twenty-one, because for the first seven years of his life he is a charge to his parents, for the second seven years he is self-supporting and during the third seven years he repays the outlay for the first period. However this may be, there is no doubt but that children are more welcome when they add to the family income than when they take from it. A definite relation exists between the economic demand and the supply of children. A leading economist has argued that the population of the United States would be the same had there been no immigration. There are more children in farming communities and in factory towns than elsewhere; laws against child labor decrease the number of children.

As sentimental vegetarianism, if general, would exterminate most of the domestic animals, so humanitarian efforts for the welfare of children tend to exterminate them. The school is the most potent factor. When the well-to-do and professional classes must support their boys until the age of twenty-five and their daughters until twenty-two —a thousand dollars a year for each is not regarded as an excessive allowance—the limit of economic possibility is soon reached. And the burden on the poor is relatively as great when they send their children to school to the age of twelve or sixteen, after which they go off to shift for themselves. It looks as though the state would need to add to free schools not only free books, free sports, free transportation, free food and free clothes, but payment to parents for the time of their children—an ominous outlook for society. Charitable and state institutions other than schools, such as hospitals and old-age pensions, make children less desired. It is an old saying that a father can support seven children, but seven children can not support one father; still every father does believe that his children will come to his aid when needed. If he sends them off to school to be taken care of

by the state, and in turn looks to the state to take care of him, the state may have to pay for the bearing of children as well as for raising them. And when states no longer want citizens for defense or aggression and have no peculiar institutions to support, it is not likely that the cosmopolitan world will be more ready than the individual to sacrifice present pleasures in order that there may be posterity.

In addition to the psychological and economic effects of the school subversive of the family, the physiological effects are serious. The health of our children is in large measure conserved by the inefficiency of our teachers. If children really did what our scheme of education asks, the results would be much worse than they are. It is also true that conditions at home, especially in cities, are such that the school may be an improvement. But the ordinary defective eyesight and lateral curvature of the spine are signs of deep-seated injury to the nervous system and bodily organs. Schools are centers for the spread of contagious diseases. The sedentary habits are not only injurious at the time, but are likely to persist, and the result is that but few educated people have normal circulations, digestions and reproductive systems. Alcoholic drinks, tobacco, coffee and medical drugs are used to replace the stimulation that should be obtained through normal work and out-of-door exercise. Some must do too much physical work and are never rested, while others shirk it altogether and are permanently tired.

It is generally assumed that the small family and diminishing birth rate are due to psychological and economic causes, but it is probable that physiological and pathological conditions are equally potent. When there is no child or but one, until recently at least, physiological infertility may be assumed; and this class represents one third of all families of college alumni. Among these alumni, a considerable percentage of whom are clergymen, large families such as were formerly common simply do not occur, and it is difficult to believe that voluntary restriction is absolutely universal. Among women of the American upper classes there are probably about as many miscarriages as births, and probably less than one fourth of all mothers can nurse adequately their infants. The small family is often due to voluntary restriction in deference to the health of the wife.

It is quite impossible to determine the extent to which the failing birth rate is due to physiological infertility or the extent to which this is chargeable to the schools. It has been held that intellectual development inhibits the reproductive function; in Malthusian days this was even urged as a beneficent plan of nature. Girls are injured more than boys by school life; they take it more seriously, and at certain times and at a certain age are far more subject to harm. It is prob-

ably not an exaggeration to say that to the average cost of each girl's education through the high school must be added one unborn child.

Our system of coeducation is favorable to conventional morality, but not to romantic love. A man is no more a hero to his girl chums than to his valet; a certain distance is necessary before the halo about a girl's head becomes visible. Small doses confer immunity to the larger passions. The 40,000 girls now in our colleges are putting off marriage beyond the age when impulse is dominant. This is regarded as one of the merits of the system; but it means that half of them will not marry and that the other half will have families of the average size of two children. Women of this sort ask too much of the men. They want a kind of education and a kind of interests that can not be universal; they are not content to begin with the simple servantless ménage that satisfied their parents. It is well for family happiness when husband and wife have interests in common; a university professor can have to advantage a college-bred wife. But the superficial culture of the American woman, the reading of the monthly magazines and best-selling novels, the frequenting of those theaters, art exhibitions and women's clubs, for which the husband has no time or taste, are not conducive to harmony and homogeneity in family life.

The economic employment of women in sedentary work and work away from home, which is such a marked development of modern and especially of American conditions, obviously tends to prevent marriage, to limit the number of children and to break up the family. When spinsters can support themselves with more physical comforts and larger leisure than they would have as wives; when married women may prefer the money they can earn and the excitement they can find in outside employment to the bearing and rearing of children; when they can conveniently leave their husbands should it so suit their fancy —the conditions are clearly unfavorable to marriage and the family. It is further an important consideration that men who must compete in the market with women can not afford to marry and support a family. Here again the school and the employment of female teachers are dominant factors.

There are in the United States about 400,000 women employed as teachers, and the numbers are continually increasing. In our cities there were at the time of the last census 76,348 female and 6,302 male teachers, and the proportion of females has since increased, so that now probably not more than one teacher in fifteen is a man. In one Ohio town there are about 200 female teachers without a single man. In the graduating class of a California normal school this year there were 272 girls and one man. In Germany, on the other hand, about two thirds of the teachers are men.

This vast horde of female teachers in the United States tends to

subvert both the school and the family. The lack of initiative and vitality in our entire school system is appalling. The influence of our half million teachers on the problems of democracy and civilization is entirely insignificant. The attractive and normal girls and the few able men tend to drop out, leaving the school principal, narrow and arbitrary, and the spinster, devitalized and unsexed, as the dominant elements. Boys get but little good from their schooling and leave it when they can. Girls, who need men teachers even more than boys, predominate in the upper classes. Women are good teachers, especially young girls with their intuitive sympathy for children and mothers who have bred children of their own, and women are cheaper than men of equal education and ability. But the ultimate result of letting the celibate female be the usual teacher has been such as to make it a question whether it would not be an advantage to the country if the whole school plant could be scrapped.

It has been urged that the backwardness of the middle ages was due to the fact that the ablest men were selected for celibacy; with equal plausibility it might be argued that the 400,000 American women teachers withhold the million children who might give to our country the intellectual distinction that it lacks. However this may be, it is certain that the homes and the children are lacking; and in every school patterns are set to be copied in the next generation with disastrous results.

It will doubtless be thought by most of those who read this paper that the futility of our present educational scheme and the evil effects of the school on the family have been exaggerated. The rhetorical phrases that have been used to give emphasis may leave an impression of lack of sanity and humor. It is indeed true that the shadows rather than the lights have been depicted. It would be possible to write in praise of universal education and the humanity of modern civilization, to tell once more how the American school opens the gateway to any career to every child, and how woman has been freed from a slavery as complete as that to which any race has been subjected. But it is not the object of this paper to relate the progress of civilization; its aim is to draw attention to certain poisonous by-products in the hope that antidotes may be found, and to make a suggestion tending in this direction.

The proposal—not likely to be heeded, for if it were, then its need would largely disappear—is that the teacher should be the family and so far as may be that the scholar should be the family.

In the last of the often-read tales that give distinction to American literature, we learn how the traveler, after a weary world search for the three fatalities that should give him love, treasure and influence, returns to his native New England village to find them there in a wife

who had been the playmate of his childhood, in tilling the earth of his garden and in teaching the country children. One of the great novels of the greatest living master of letters tells how the heroine failed to find her hero in the warlord, but found him in the schoolmaster, when together among the hills they taught their boys the ways of truth and honor.

Is there indeed in all the wide world a better place than a home in the country where parents and children are doing what they can for themselves and for the neighborhood? The clergyman and the physician are, by the character of their professions, half missionary and half charlatan; in the lawyer and the journalist the missionary element is decidedly less. But there might be in this broad land of ours five hundred thousand men, as many women, twice as many children, all leading lives wholly useful and noble, as teachers in their communities. The money is there; the men and women are not lacking; the children need not be; it is only the spirit and the will that fail.

Can one not fancy a school in the country, the house a model of simple beauty, built and adorned from year to year by those whose use it serves? It would be adjacent to or perhaps a part of the home of the teachers, surrounded by gardens, orchards and barns. The house would be fitted out as a club, with books, pictures and music continually renewed. Its furniture, its lighting, its ventilation, its heating, its water-supply and baths, its workshop, its kitchen and laboratory, all would offer a standard for the neighborhood. In this house the children would gather, and so far as might be the older folks, for some two hours a day. The master and the mistress and their older children, with the help of others who were able, would teach the tricks of reading, writing and reckoning to those who lacked them, and all would be encouraged to go as far as they cared along the paths of letters and science. Two further hours might be spent in working about the place, in the shop, in the garden or with the animals, sewing, cooking or cleaning, learning to do efficiently and economically the things that must be done. The children and older folks would gladly return to the school for sports and games, indoors and out, for books and music, for theatricals, lectures and meetings, to eat and to gossip.

A school of this kind would be supported mainly by the work of those whom it served; perhaps no taxation would be required; in any case the money needed for the master, the mistress and their children to live in quiet elegance would not be much. The garden or intensively cultivated farm with the equipment of the school would need to be supplemented by a minimum of ready money. To each school might be added some productive concern—the raising of strawberries, mushrooms, or squabs, a creamery, smithy or printing shop. The teachers, and to a certain extent the people of the neighborhood, would

be experts in some one line; they would do this special work as well as it could be done and be alert to improve the methods. Prentices would be trained who could carry expert skill to other neighborhoods.

The master and the mistress would have ample time. Four hours a day might be devoted to the children of the school, in work only partly sedentary. The wife could be spared when higher duties demanded, and the man could devote himself for a time to the completion of some pressing work. Both could have some trade or profession in addition to the teaching. It might be only the care of the school and garden—the postoffice would naturally be there—or the village shop might be added, or one of them might be skilled in carpentry, plumbing or surveying. They might edit and print the country newspaper, or a special journal whose edition of four hundred would go to all quarters of the world. One or both of them might be physicians, promoting hygiene and public health, knowing their own limitations and the limitations of the profession, able to refer patients to the best specialists within reach. Or one might be himself a specialist, spending part of the year at the university and city hospital, carrying forward researches in experimental medicine. The teacher might—could the jangling of the creeds be hushed—be the village clergyman; or he might be the lawyer, drawing up deeds and wills, suppressing lawsuits, showing the ways of justice and mercy. The teachers might be devoted to science, letters or art, perhaps applying the better methods to agriculture or industry, writing verses for the country papers, or training the choir; but here and there would be one able to move forward the boundaries of science, to write what would be read far off and long after, to create art in touch with the emotions of the people.

Five hundred thousand families, continually increasing in numbers, engaged in learning and in teaching, would give to this country a true democratic aristocracy. Into it would be taken the best elements of all the people, and from it would be chosen leaders in every department of human activity. Sons and daughters would return to carry forward the work of their parents; family sanctions and traditions would be maintained from generation to generation. Children would always be the chief concern in a home and in a school such as this. There would be no pathological, no economic, no psychological conditions at work for their extermination. Mothers fit to bear and nurse their young would be selected and trained. Children would not only be the chief treasure sought; they would also add to the material wealth of the family. Those who did not want children would be cast aside as little better than the abortionist and the infanticide. In all the world there is nothing more ultimate than the primitive voices of the two Rachels; Rachel weeping for her children, not to be comforted, because they are not; Rachel who said: Give me children, or else I die.

THE PROGRESS OF SCIENCE

WOLCOTT GIBBS

OLIVER WOLCOTT GIBBS, one of the few great men of science given to the world by the United States during the first part of the nineteenth century, died at his home in Newport on December 9. He was born in New York City on February 21, 1822, his father, Colonel George Gibbs, being one of the earliest American mineralogists, and his mother, Laura Wolcott, the daughter of Oliver Wolcott, secretary of the treasury under Washington and Adams, being an artist of ability. Gibbs graduated from Columbia College in 1841, and received the degree of doctor of medicine from the College of Physicians and Surgeons in 1845. In the meanwhile he had been assistant to Dr. Robert Hare, professor of chemistry in the medical school of the University of Pennsylvania. The next three years were spent abroad; and work was carried on in the laboratories of Rammelsberg and Rose in Berlin, Liebig in Giessen and Regnault in Paris. In 1849 he became professor of chemistry and physics in the Free Academy, later the College of the City of New York, and in 1863 he was elected Rumford professor in Harvard University. In 1887 he became professor emeritus and retired to his home at Newport, where he equipped a laboratory for his chemical researches.

The researches that he accomplished give distinction to this country. His work on the electrolytic deposition of copper as a means of quantitative analysis has become of great significance, and many other methods of quantitative analysis were improved under his guidance. Other works of great importance were his extended experimental studies of complex salts, especially the cobaltamine compounds and those containing some of the rarer elements. These are of great theoretical interest, owing to their relation to theories of molecular structure.

Gibbs was the last surviving founder of the National Academy of Sciences, which he served as president; he had been general secretary, vice-president and president of the American Association for the Advancement of Science. He was a member of the Prussian Academy of Sciences and the only American honorary member of the German Chemical Society. His work was recognized by many other societies, and by honorary degrees conferred by Columbia, Harvard, Pennsylvania, George Washington and Toronto Universities.

A portrait of Gibbs was published in THE POPULAR SCIENCE MONTHLY for June, 1900. There is here reproduced a letter addressed to the editor in answer to a request for an article. This letter illustrates the courtesy and kindness not less characteristic of Wolcott Gibbs than the eminence of his services to science.

OTIS T. MASON

OTIS TUFTON MASON, head curator of the department of anthropology in the United States National Museum, died at Washington on November 5, in his seventy-first year. He was the son of John and Rachel Thompson (Lincoln) Mason, and was born at Eastport, Maine, April 10, 1838. He was graduated from Columbian (now George Washington) University as A.B. in 1861 (A.M., 1862; Ph.D., 1879; LL.D., 1898). In the following year he married Sarah E. Henderson, and at once entered on his career as a teacher. As principal of the preparatory department of Columbian College, from 1861 to 1884, he used his oppor-

Oct^r 5^th 1904

GIBBS AVENUE
NEWPORT R. I.

Dear Prof Cattell

I would very willingly comply with your request to write for your excellent and most valuable Journal but I am wholly unable to do so. I am now in my 83^d year and do little besides keeping up with the progress of Science as well as I can but without offering any suggestions or thoughts of my own. You are doing excellent work and I sincerely wish that I could aid you

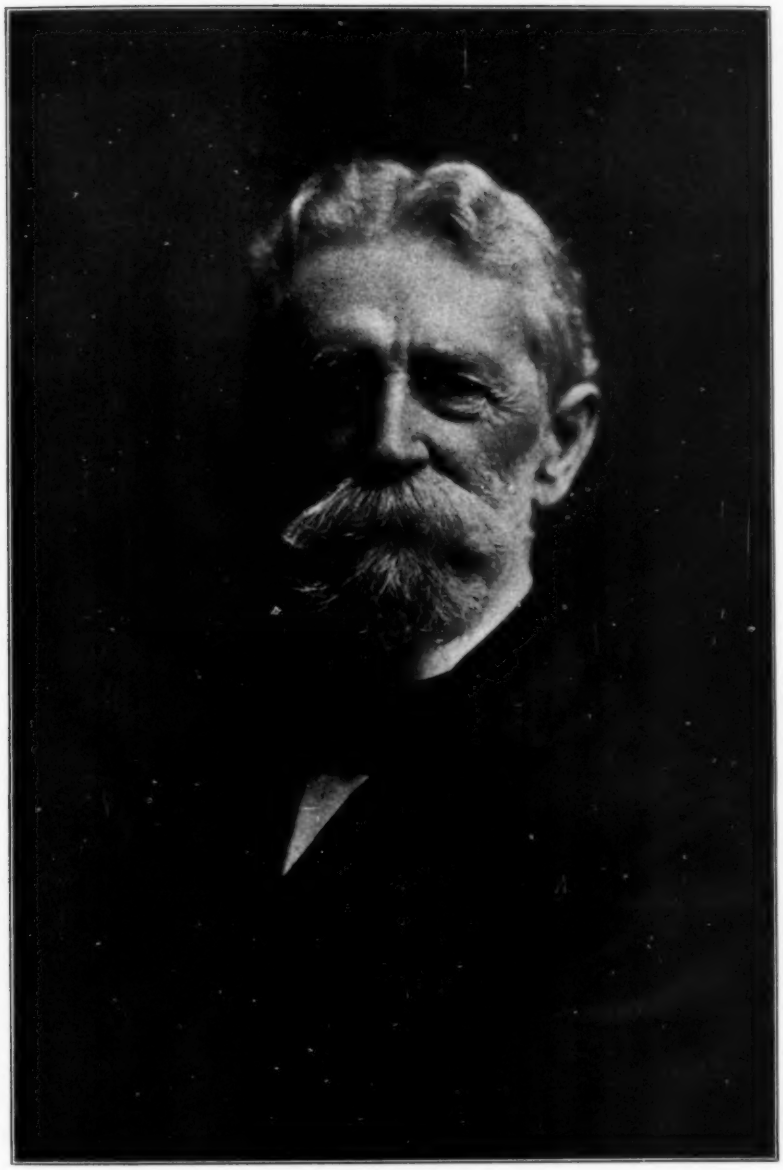
Yours truly
Wolcott Gibbs

tunities for leading the young into correct methods of study, and every leisure moment out of the classroom for perfecting himself in those original investigations that were his life work.

Mason's interest in anthropology began in his boyhood days, and his inspiration may be traced directly to the enthusiasm with which he read a copy of Guyot's "Earth and Man" that accidentally came into his hands. Following Guyot, the writings of Maury, Guizot, Lane Fox, Klemm, Lubbock, Tylor and Evans were devoured, and his text for life became "thoughts in things, or human history written in human inventions." Ever a devout churchman and a leader in Sunday-school work, he equipped himself with a knowledge of Biblical archeology, which subject he pursued assiduously whenever opportunity afforded. His deep and growing interest in this and kindred studies attracted, in 1873, the attention of Professor Joseph Henry, secretary of the Smithsonian Institution, through whose influence Mason's studies became diverted to the American field at a time when but few students were aware of the fruitfulness and the possibilities of the western continent for ethnological and archeological research. In the same year he was made a collaborator of the Smithsonian Institution, and commenced to compile the synonymy of the North American tribes—the inception of what has developed into the "Handbook of American Indians," now in process of publication by the Bureau of American Ethnology. He also prepared schemes for anthropological exhibits at the Centennial Exposition in 1876, and became the editor of the anthropological summaries that appeared in "Harper's Annual Record of Science and Industry" (1874–8), in the *American Naturalist* (1876–87), and in the *Smithsonian Reports* (1875–93). Professor Mason was appointed curator of anthropology in the United States National Museum in 1884, and head curator of its department of anthropology in 1902.

Otis Tufton Mason was the most charming of men. Kind, generous, considerate, patient beyond measure, with a fount of humor that bubbled forth on every occasion, one would never suspect from outward appearance that the best years of his life had been blighted by mental anguish. Paralyzed after having passed his sixtieth year, he began life anew, as years before he had begun again, after years of application, when Henry advised him to drop the eastern Mediterranean field and adopt America as the subject of his labors. His right hand being practically dead, in a few weeks he learned to write as well with the left, and planned further work with bravery worthy of a young man in prime physical condition.

Being essentially a worker among collections, Mason's activities were devoted chiefly to the material culture of primitive peoples. This is exemplified by his writings on the "Latimer Collection of Antiquities from Porto Rico" (1876); "Basket-work of the North American Indians" (1884); "Throwing-sticks in the National Museum" (1884); "Cradles of the American Aborigines" (1887); "North American Bows, Arrows and Quivers" (1893); "Origins of Inventions" (1895); "Aboriginal American Zootechny" (1889); "Aboriginal American Basketry" (1902), and many others. He insisted that the most rigid methods of the naturalist should be applied to the investigation of human problems, and that every human act and invention be subjected to this close scrutiny. His long experience in the training of youth made him ever a willing guide and instructor of those in search of the knowledge that he possessed, and many a young student received his first impetus in the study of ethnology through Mason's friendly aid. His scientific papers, numbering many score, are written largely in popular vein, as if designed for the benefit of youth rather than for his fellow



OTIS TUPTON MASON.

workers. With Mason passes one of the founders of the Anthropological Society of Washington in 1879, in the activities of which he took a most prominent part while health lasted, serving as its president from 1893 to 1895. His associates will miss his cordial greeting, his fatherly advice and encouragement, his tender sympathy, the cheering atmosphere that one always felt when in his presence. In time to come Mason will be recognized as the pioneer in the classification and analysis of the material culture of the American aborigines.

THE H. K. CUSHING LABORATORY OF EXPERIMENTAL MEDICINE OF WESTERN RESERVE UNIVERSITY

THE school of medicine of the Western Reserve University, which is one of those in this country maintaining the highest standards, has been fortunate in receiving from Mr. H. M. Hanna and Colonel Oliver H. Payne a gift of $200,000—to which they have just added $17,000 towards the endowment—for a laboratory of experimental medicine, named in honor of one of the distinguished professors of the school in its early days. The laboratory was dedicated on November 20, when, after a welcome by President Thwing, the principal address was made by William H. Welch, M.D., LL.D., professor of pathology in the Johns Hopkins University. An address was also made by George Neil Stewart, D.Sc., M.D., professor of experimental medicine and director of the new laboratory.

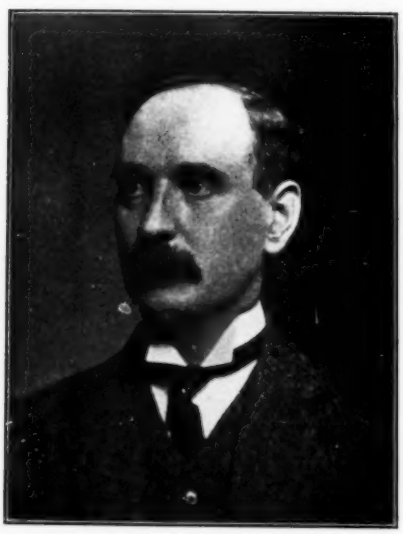
The new laboratory adjoins the main building and the physiological laboratory building of the Medical School.

THE ORIGINAL BUILDING OF THE WESTERN RESERVE MEDICAL SCHOOL, erected in 1844 for the Cleveland Medical College. Replaced in 1887 by the present main building of the Western Reserve University Medical School.

It is four stories high, of reinforced concrete, faced with brick, and complete in all its appointments. The building contains laboratory rooms, a balance room, a library, photographic rooms, rooms for individual investigations, a refrigerating room, rooms for conducting studies in the nutrition of animals, store rooms, workshops and the office of the director.

The H. K. Cushing Laboratory will fill an important place in the field of medical research and education. So long as medicine was a comparatively simple science it was possible for the physician, while actively practising his profession, to keep himself sufficiently in touch with the fundamental medical sciences such as physiology, anatomy and pathology. The rapid advance, both in the practical arts of medicine and surgery and in the underlying sciences on which they depend has rendered it impossible for any one man to dominate both fields. Therefore the time seems to have come for improving the means of coordinating practical medicine and the medical sciences. It is proposed to accomplish this at the Western Reserve University by the establishment of a laboratory and chair of experimental medicine, the occupant of which and his assistants shall be expected to keep themselves in touch, so far as is possible, with clinical work, on the one hand, and physiology and pathology, on the other, and to encourage and direct investigation having a bearing upon both. The new foundation is intended to form a link between the knowledge of the laboratory and the knowledge of the hospital.

DR. WILLIAM H. WELCH,
Professor of Pathology in the Johns Hopkins University, who delivered the principal address at the dedication of the H. K. Cushing Laboratory of Experimental Medicine of Western Reserve University.



DR. NEIL STEWART,
Professor of Experimental Medicine and Director of the H. K. Cushing Laboratory of Experimental Medicine of Western Reserve University.

The researches which in the future may be carried out in this laboratory are planned to have, as far as possible, a direct practical bearing upon clinical questions. For example, some light has been thrown by experimental investigation on the pathology of such conditions as goitre, diabetes, gout, the anemias, ulcer of the stomach, etc.,

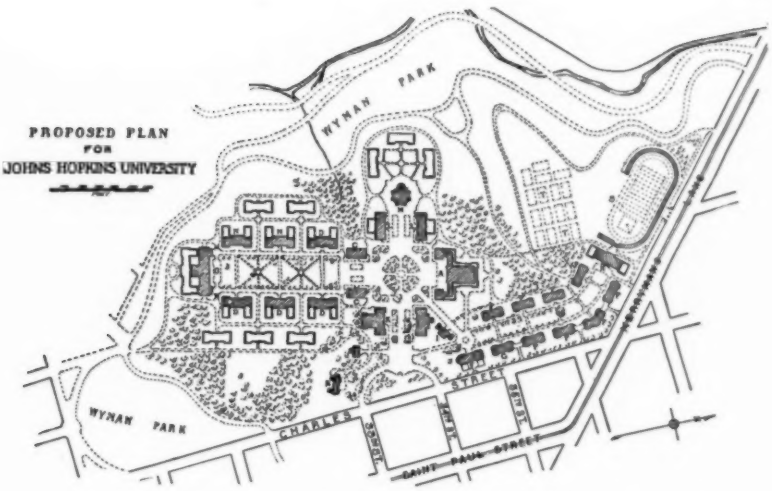
THE MAIN BUILDING AND PHYSIOLOGICAL LABORATORY BUILDING OF THE WESTERN RESERVE MEDICAL SCHOOL, Cleveland. The main building is of brown stone, and comprises four floors and a basement. It contains two amphitheaters and the Laboratories of Anatomy, Histology and Embryology, Pathology and Bacteriology and Pharmacology. The building was first occupied in 1887 and cost $240,000. The Physiological Laboratory was built in 1898. It houses the Laboratories of Physiology and Physiological Chemistry with private research rooms and work shops.

but very much remains to be discovered. A deeper insight into problems of this kind may be obtained if investigators at the same time as they are working at the subject from the experimental standpoint in the laboratory, are in a position to study clinical cases of the disease in the hospital, and this it is planned to do in the H. K. Cushing Laboratory.

THE CONVOCATION WEEK MEETINGS AT THE JOHNS HOPKINS UNIVERSITY

THE scientific meetings to be held at Baltimore during the week following that in which Christmas falls promise to be of very great interest. In addition to the American Association for the Advancement of Science, with its eleven sections covering the entire field of the natural and exact sciences, no less than twenty-five independent societies will meet in affiliation. These national societies include those devoted to mathematics, physics, chemistry, geology, geography, paleontology, physiology, astronomy, bacteriology, zoology, entomology, botany, psychology, philosophy and anthropology. The officers and members of the American Association, of the American Society of Naturalists and of these special societies, are practically identical with the productive scientific men of the country. It is likely that fully two thousand of them will be at Baltimore and that the number of papers read will exceed five hundred.

While the special scientific societies and their technical programs are probably the chief factors promoting and guiding the advancement of science in this country, a large meeting of scientific men has certain other advantages, the most important of which are per-



Present needs: A, Library; B, Administration Building; C, C, Class Rooms; D, D, D, D, Laboratories; E, Levering Hall (Y. M. C. A.); F, Dining Hall; G, Dormitory; H, Gymnasium; S, Athletic Field; T, Tennis Courts. Future needs: K, Assembly Hall; L, L, Museums; M, Chapel; N, N, Laboratories; O, Museum; P, P, P, P, P, P, P, Dormitories; R, President's House.

haps the widening of personal interests and acquaintance, and the development of a spirit of loyalty to science and scientific ideals. The machinery for conducting a large meeting of this character is not fully adjusted—it is only five years ago that the first of the convocation week meetings was held in Washington—but each year the friction has become less, and the advantages have become more evident.

The first general meeting will be held at ten o'clock on the morning of December 28 in McCoy Hall of the Johns Hopkins University. Addresses of welcome will be made by Dr. Ira Remsen, president of the university, and Dr. William H. Welch, chairman of the local committee, both past presidents of the association, and the president of the meeting, Professor T. C. Chamberlin, will reply. In the evening, the retiring president, Professor E. L. Nichols, will give his address, and during the week the vice-presidents for the sections and the presidents of many of the special societies will make addresses. These will in most cases be of general interest to scientific men, and special sessions will be arranged that will be of general interest. The most notable is an entire day (January 1) with a dinner in the evening devoted to the celebration of the one hundredth anniversary of the birth of Charles Darwin and of the fiftieth anniversary of the publication of the "Origin of Species." A symposium on public health will be held on December 31.

When the Johns Hopkins University was opened in 1876, it adopted the wise policy of spending its means on men rather than on buildings. Its laboratories are, however, admirably equipped, and with its medical school—unfortunately at some distance from the other departments—it offers all needed facilities for a large scientific meeting. The university will, when money is obtained, remove to the beautiful site it has purchased on the outskirts of the city. In addition to athletic grounds there is at present in use only some equipment for the botanical department. The site will be developed and buildings erected in accordance with the plan here given.

SCIENTIFIC ITEMS

In addition to Wolcott Gibbs and Otis T. Mason, the country has lost in the death of William Keith Brooks one of its most eminent men of science. A biographical sketch of Professor Brooks, who had been professor of zoology at the Johns Hopkins University since 1876, together with a portrait, will be found in the issue of The Popular Science Monthly for July, 1899. We regret also to record the death of Dr. Andrew J. McCosh, a leading surgeon of New York City; of M. Alfred Ditte, the French chemist, and of W. E. Ayrton, the British physicist and electrician.

Dr. Richard C. MacLaurin, for the past year professor of mathematical physics in Columbia University and previously professor of mathematics in the University of New Zealand, has been elected president of the Massachusetts Institute of Technology.—Professor W. W. Campbell, director of the Lick Observatory, has been appointed lecturer for next year on the Silliman foundation at Yale University.

Nobel prizes in the sciences for 1908 have been awarded as follows: For chemistry, Professor Ernest Rutherford, director of the physical laboratories of the University of Manchester, England; for physics, M. Gabriel Lippmann, professor of physics in the University of Paris; for medicine, divided between Dr. Paul Ehrlich, of Berlin, and Professor Elie Metchnikoff, of the Pasteur Institute of Paris.

The Royal Society has awarded medals as follows: the Copley medal to Dr. Alfred Russel Wallace, in recognition of the great value of his numerous contributions to natural history, and of the part he took in working out the theory of the origin of species by natural selection; the Rumford medal to Professor H. A. Lorentz, for his investigations in optical and electrical science; a Royal medal to Professor John Milne, for his preeminent services in the modern development of seismological science; a Royal medal to Dr. Henry Head, for his researches on the relations between the visceral and somatic nerves and on the functions of the afferent nerves; the Davy medal to Professor W. A. Tilden, for his discoveries in chemistry, especially on the terpenes and on atomic heats; the Darwin medal to Professor August Weismann, for his eminent services in support of the doctrine of evolution by means of natural selection; the Hughes medal to Professor Eugene Goldstein, for his discoveries on the nature of electric discharge in rarefied gases.